The *REAL BOOK* of
GOLD

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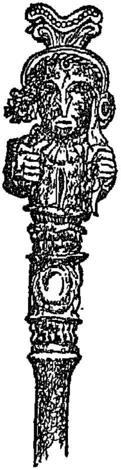

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1: GOLD IS FASCINATING

IF YOU would like to be a millionaire all you have to do is go to a gold-producing country, like the United States of America, and dig a ton of gold. It does not take a very big pile of gold to weigh a ton. You can melt and cast that much precious metal into a block only a little less than fifteen inches long, fifteen inches wide, and fifteen inches high. For this cube of gold—no larger than a fair-sized block of ice—the U.S. Mint will pay you nearly 1,150,000 dollars.

Of course, your chances of finding a ton of gold these days are slim. And people nowadays do not seem so keen on seeking gold as they once did. In days gone by gold played a very important part in people's lives. From the earliest times right up to the twentieth century it drove men to the boldest deeds. It made some bloodthirsty and cruel, and led others even to risk their lives. Gold caused human misery and war, but it also led to the conquest of many frontiers.

What *is* gold? What is this mysterious metal that has stirred the human heart to such adventure? Why have people always been so excited about it? Where

has it been found? Where can you see it today? Who owns the gold that is already dug? What do they do with it? Would we care about gold if it were cheap?

This book will tell the real story of gold from ancient times down to the present. And it will try to give real answers to all these questions.

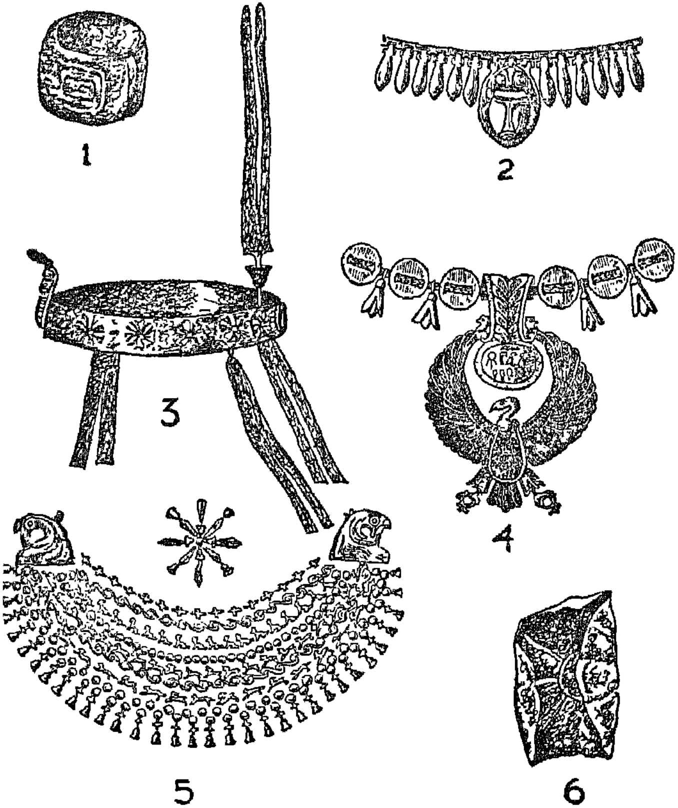
•

Thothmes III was ruler in Egypt 3,400 years ago. In his golden chariot he led armies into Syria and Babylon and captured slaves to mine gold in Nubia. Sometimes the gold in this Pharaoh's possession weighed half a ton a year. He made many gifts to the temple of the god Amon, including a statue of himself in solid gold, dressed like this god. All his life he himself was worshipped as an immortal being and as Amon's son.

In some of the great museums of the world you can see jewellery from ancient Egypt. When you see the beautiful rings and necklaces you can readily imagine how the ladies of Thothmes' court shone with gold. Here is a headdress of gold plate with rosettes of gold and precious stones hanging from it like curls. There is a necklace with curious pendants that look like real flies but are made of gold. Gold figures of cats twist among coloured beads and form a bracelet. Cosmetic jars—made to hold oils, pomades, eye paint, and rouge—have lids and bands of gold. A mirror of polished silver stands upright on its gold-covered handle. In it you can see your reflection after more than three thousand years.

Some princess or queen made herself beautiful with the aid of this mirror. But she has long since had need neither of the mirror nor of the golden sandals you will also see in the museum's galleries. These were not ordinary sandals. They were placed on her dainty feet in the tomb for the hard trip to the other world. Each toe was first wrapped in linen. Over it, snug as a glove, went a golden toeguard. There were other guards for the fingers. You can see marks like toenails and fingernails worked into the gold.

Preparing a royal mummy called for bandages and ointments and, above all, a great deal of gold. In 1922 the burial chambers of Tutankhamen were discovered in the Valley of the Tombs of the Kings.



Ancient Egyptian jewellery

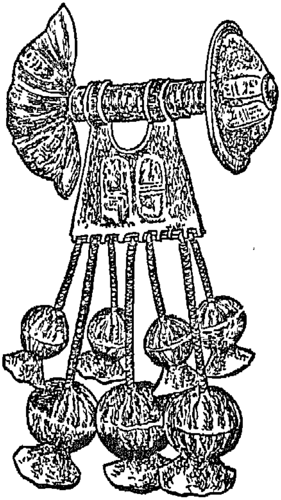
(1) and (6) Ring and ornament of Queen Tauosrit. (2) and (4) Fragments of Egyptian collars. (3) Gold crown of Princess Sat-Hathor-Iunut. (5) Enamelled gold necklace of Queen Ahhotpu.

This king died in his youth a hundred years after Thothmes III. Three coffins, one inside another, held his body. The outer ones were covered with gold, the inner coffin was of solid gold. A mask of gold shielded the face of the young Pharaoh. On his head was a diadem of gold and precious stones, bearing the image of the sacred cobra. This hooded snake, ready to strike, was a sign of the king's power of death over his subjects.

Since the year 1349 B.C., Tutankhamen had lain in the splendour of his tomb. Near him was his throne, overlaid with gold and carved with lions' heads and winged cobras. It is still in Egypt, in a Cairo museum. The panels of the throne display quiet scenes. One shows water birds in flight over quiet rushes. In another, the king rests on a cushioned stool while the young queen playfully anoints his shoulder with oil. They look like a carefree boy and girl.

Buried with the boy king were priceless objects of gold and the toys he had played with only recently. An inscription on the walls of the tomb begged that his spirit might be allowed to enjoy this pleasant home and the cool breeze of the valley for thousands of years. If gold can make it so, the wish was surely granted.

Gold was thought of by the Egyptians as the



Egyptian ceremonial wig ornament

metal of the sun. It was like the sun in at least two ways. First, just as fire did not destroy the sun, so, too, it could not ruin gold. Baser metals—metals of lesser value—turned to waste matter in the crucible, and when they were drawn off gold remained. Secondly, the sun went down at night into the Land of the Dead but returned in the morning to brighten the days of the living. And similarly, gold, its metal, gave cheer in this world and hope of life hereafter.

Solomon was king of Israel four centuries after Tutankhamen ruled in Egypt. The Bible calls King Solomon "wiser than all men." In his youth he asked the Lord for—and was granted—"a wise and understanding heart." He was given riches and honour too. In gratitude, Solomon built in Jerusalem a golden temple to the name of the Lord. It stood on the crest of a mount beyond his palace.

Cedars of Lebanon supplied beams and planks for the temple. The walls were made of stone. From the Holy Place of the temple, doors of olive wood with golden hinges led to the Holy of Holies. Here was the gold-covered altar and other precious golden objects—censers, basins, lamps, snuffers, and candlesticks with seven branches.

The most dazzling objects were the cherubim—two winged figures with lionlike bodies, standing as high as three men. Their spreading wings spanned the room from wall to wall. Safe under these wings, in the Holy of Holies, stood the most precious treasure of all—the ark of the covenant.

The story of this ark was the story of a promise fulfilled. Long before Solomon's time, when Moses was leading the children of Israel through the desert on the flight from Egypt, they had to pass many days in hunger and thirst. At night they heard the cries of wild animals. They longed for the fleshpots of Egypt where, though slaves, they had had their fill of bread and meat. Despairing of help, the wanderers melted their earrings and made an image of the Golden Calf.

Moses came upon his followers worshipping the idol and dancing about it. Very angry, he melted down the Golden Calf and ground it to pieces. For God had commanded the Israelites to worship no other God before Him. Then, as a constant reminder of the Lord's true commandments, Moses built the ark. In this chest of acacia wood covered with gold, he placed the tablets of the law. Over the ark was a thick slab of gold called the mercy seat.

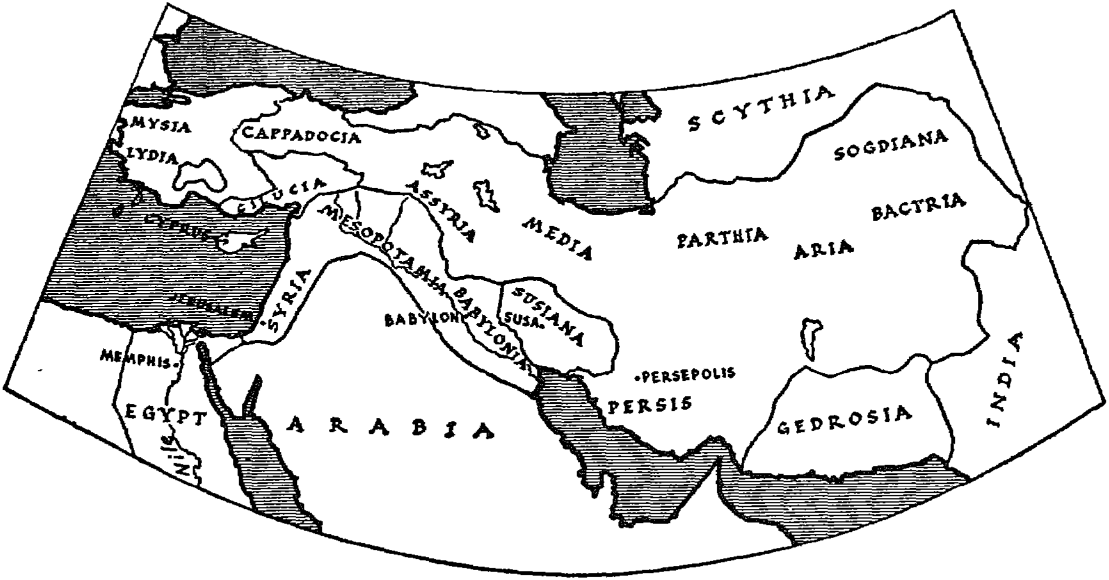
The ark of the covenant was a sign that the wandering people would find homes in a Promised Land of milk and honey. This came to pass. By the time King Solomon placed the ark under the golden wings in the Holy of Holies, the Hebrew kingdom had reached new heights of power and glory.

Rulers of other lands came to see King Solomon's wealth and hear his wisdom. He knew three thousand proverbs and had a thousand songs about trees, beasts, and fowl, creeping things, and fishes. From deep in Arabia the Queen of Sheba brought a camel caravan with spices, gold, and precious stones for Solomon. Though rich herself, she was astonished at Jerusalem's grandeur.

The queen looked at Solomon's throne of ivory and gold, drank from his golden vessels, and walked through the House of the Forest of Lebanon with its cedar columns and shields of beaten gold. She could hardly believe her eyes.

Hiram, King of Tyre, was also Solomon's good friend. Tyre was a city of the Phoenicians, who traded in metals and purple dye. Hiram and Solomon sometimes joined forces and sent fleets to the mines of Ophir for gold. Ophir may have been a part of Arabia more distant even than the land of Sheba. It took the ships three years to come back. Then they brought gold, silver, ivory, apes, and peacocks, a treasure worth waiting for.

After Solomon's reign, the kingdom was never again so rich, though his golden temple was a centre of worship for almost four centuries. Then an invading army under King Nebuchadnezzar looted the gold, burned the temple, and led the Jews to captivity in Babylon. This happened about the time Croesus, king of Lydia, was born.



ANCIENT EMPIRES OF THE EAST
606 TO 522 B.C.

2: RICH AS CROESUS

CROESUS ruled in Lydia during the sixth century B.C. His empire included most of Asia Minor. To this day, being "as rich as Croesus" means having unimaginable wealth.

Well—how rich was Croesus?

No one can say how rich he was in terms of money. He gained his wealth in part by collecting tribute from cities he had conquered, and by taxing the trader caravans which crossed Asia Minor on the road between Greece and Babylon. Visitors to the royal palace at Sardis were amazed at the splendour they saw there.

Croesus loved to show his wealth. He led the way through chambers full of chests inlaid with gold and couches covered in cloth of gold.

One room was for helmets, shields, and swords. Croesus liked to lift a gleaming spear from the wall and say, "Both the head and shaft are of solid gold. Of course the metal is too soft for use in battle. But it can be melted down to pay for many spears of iron."

Gold was everywhere. The high-pillared throne room blazed with gold. Guests drank from vessels

of gold and dipped their fingers in golden basins filled with perfumed water, while a musician plucked a golden lyre. The queen was dazzling in her golden jewels and ornaments.

In the palace gardens, jets of water spurted from a golden statue. The royal stables glittered with gold trappings.

King Croesus always saved his big surprise for last. On the day his visitors were to leave, he took them down the stone steps to an underground treasury. Servants went ahead to light the way with lamps.

The light fell on a huge golden lion and a rampaging bull, standing face to face. Everything in the treasury was made of gold—a giant cauldron, bowls as large as boats, heaps of rings, bracelets, necklaces, and earrings. Among the golden figures of people, it was easy to recognize the woman who baked the king's bread.

"These are only toys," the king would say, leading his astonished guests to the back of the treasury. There, stacked high, were slabs of gold from the melting pot. "Try to lift one," urged Croesus.

The visitors tugged and strained. Their host broke into smiles. "I have hundreds of those slabs, all made of gold," he said. "If you were stronger, you could have one as a gift."

No one had ever seen so much gold before.

Croesus had a favourite question. "Who do you think is the luckiest man in the world?" he would ask, his face flushed with pride.

Croesus wanted to be told that he was the world's luckiest man. Guests who complied received a golden cup decorated with hunting scenes.

When Croesus was alone, he liked to visit his counting house. He would reach into a bag for some lumps of gold. They were shaped like melon seeds.

Croesus liked to show his riches to his astonished guests

Some would lie in his palm with one side up, some with the other side showing. One surface displayed a lion and a bull facing each other. The other had two square punch marks in the gold.

These oval pieces were gold coins. The lion, the bull, and the squares were Croesus' guarantee that the lumps were pure gold except for enough cheaper metal to keep them hard. Some of the bags in the counting house held larger gold coins, some smaller, and there were also silver coins of many sizes. Merchants were glad to take these coins in payment for goods. They did not have to study the metal or whang it on the table to hear it ring true. They could trust gold and silver that bore the Croesus guarantee.

Coins in weights familiar to the East travelled with the caravans to Babylon. Coins in another set of weights went west and came into the hands of seafaring Greeks. Wherever traders bought and sold, they passed the curiously marked lumps of gold round. The name and fame of the rich king who put his sign on honest gold spread far and wide.

Croesus had learned about coins from his forefathers, the kings of Lydia, where coining, as we know it today, seems to have begun. Until Croesus' time, most Lydian coins had contained a mixture of gold and silver called electrum. The two metals were often found together in Lydia. Sometimes electrum was three-quarters gold, sometimes more, sometimes less. The less gold, the paler the colour. To tell one shade from another the Lydians had to use a black stone called a touchstone. Marked on it were samples of the different shades. When they wanted to test a piece of electrum, they made a streak on the touchstone and looked to see what shade it was like.

But what a lot of trouble! How much better to have a coin of just one metal! So Croesus' father tried out gold coins, and Croesus went on and made a lot of them.

When gold passed easily from hand to hand as money, it was more valuable and Croesus became richer. Everyone wanted gold coins, and Croesus was the man who had them.

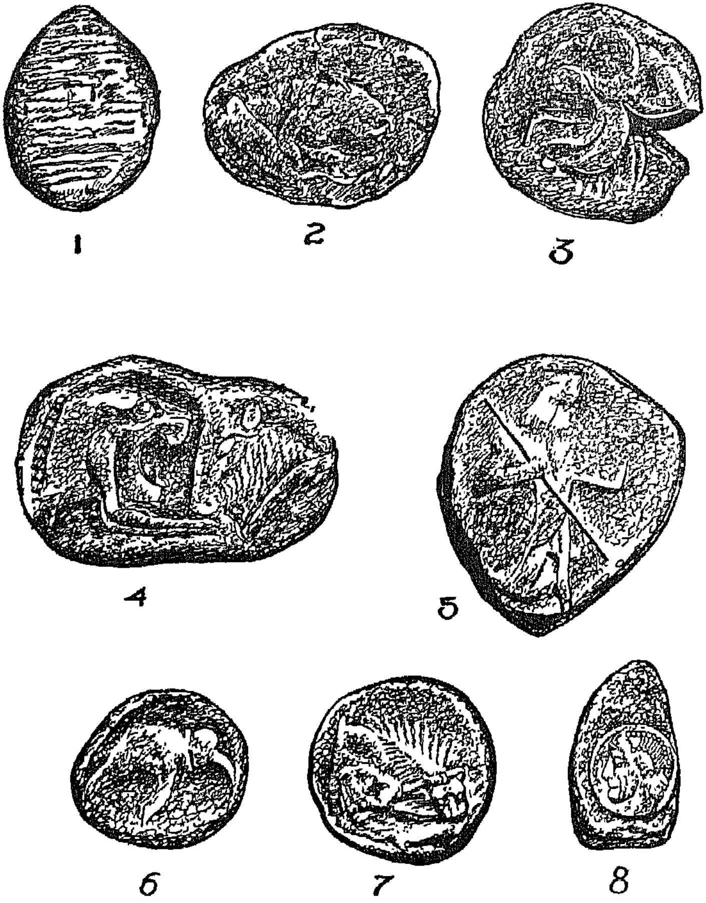
Many things had been used for money before—oxen, bronze knives and bars, shells that made pretty necklaces. None was as good as gold. Could you divide an ox into pieces and still yoke it to the plough? How many bronze bars could you carry to market? You could work gold into any shape, using a polished stone in your fist if you had no better tools. Could you do that with any other metal? Gold never tarnished or rusted. You could hide it in the ground from robbers. Two shells were never alike, any more than two oxen, but pure gold was always the same. A small load was of great value and made you welcome in the markets of any land.

Of course, rings and bracelets were easy to carry. They might be used as jewellery one day and as money the next. Merchants had scales for weighing gold jewellery and bars. It was all right to pay for large purchases with gold objects. But most of the time people swapped one article for another—until there were coins.

Lydia's early coin-makers heated a lump of electrum and hammered it on an anvil. They used a sharp punch to pound the markings into the upper side. The lump came off the anvil shaped like a bean. The under side had scratch marks where the anvil was rough to keep the lump from slipping. This is how the expression "heads and tails" began.

In Croesus' time, the rough place on the anvil was a design that punched marks into the tail of the coin under the blows of the hammer. Markings like this, dug *into* a coin, are said to be in intaglio. The lion and the bull on the other side were sunk on a die. The coin-maker would pound the die against the gold, causing the lion and the bull to show up on the head of the coin in raised relief.

Later, coins became round and flat, as they are



Ancient coins

(1) Ionia—coinlike pellet, before 700 B.C. (2) Lydia—half-lion, about 600 B.C. (3) Ionia—lion's head, 600 B.C. (4) Croesus—lion and bull, 550 B.C. (5) Persia—daric and silver shekel, 500 B.C. (6) Phocaea—seal, 540 B.C. (7) Hyele—half-lion, 540 B.C. (8) Cyzicus—Hercules and althlete, 500 B.C.

today. That made it easier to see whether anyone had clipped off some metal. Both heads and tails stood out in relief. The skilful designs showed gods and heroes, sacred symbols, birds, fish, and grain, and finally the heads of the Caesars.

Coins made it easier to travel and do business. Trade flourished as never before. People came to know one another. Somehow their neighbours were not giants with six arms after all. Silver coins from the Greek cities were in use in Spain and India. Copies of the gold staters of Macedonia were in circulation among the tribes of France and Britain before the birth of Christ. The Roman aureus, the bezant of Constantinople, the English sovereign, and the United States eagle were all descendants of the lumps of gold showing the lion and the bull. Croesus was rich in imagination as well as gold. And the world has been richer because he had a good idea.

Croesus owned a river with gold sands, the Pactolus. This mountain stream splashed down from Phrygia, where Midas once was king. Croesus knew the myth about the Golden Touch of Midas. It was a tale about what happened when a friendly god granted the king's wish that everything he touched might change into gold.

Midas plucked a twig from an oak. It turned to gold. So did a stone and a clod of earth. The king's excitement grew as he picked an apple. It was like one of the famous Golden Apples of the Hesperides. Wild with joy, Midas rushed to his palace. His touch turned chairs, tables, even the great columns, into solid gold.

Servants brought food to the king. The bread, too, became gold. When Midas drank water, it turned to molten gold in his throat. He was frightened now. He tried to devour a morsel of food before the magic touch could work—and merely broke a tooth.

The king cried out in pain. His little daughter ran to comfort him. She threw her arms about her father, and he leaned to kiss her cheek. At the touch of his lips, the rosy dimples turned to cold, yellow metal and the child stiffened into a motionless golden image.

Midas fell on his knees. "Take back the gift of the Golden Touch," he prayed. "Only let me have my daughter as she was!"

The god was merciful. "Go to the River Pactolus and trace it to its source," he commanded. "Then plunge your head and body in the stream and wash away your foolish wish. Carry back a vase of the water and sprink it on anything you would turn from gold to its former state."

Midas obeyed the command. When his little girl could run and play again, he knew that some things are much more precious than gold. As for the gift of the Golden Touch, it passed to the river. From that day on, its sands were golden.

Croesus loved to watch his miners sift out the yellow grains along the Pactolus. They did this by laying fleecy sheepskins into a wooden trough or sloping course of stones beside the river. One man dumped sand and pebbles from the Pactolus at the upper end of the slope. Another poured water over the gravel in a steady flow.

The current washed away the lighter particles. But the gold sank because of its weight and caught on the woolly fibres of the sheepskin. After many washings, the miners lifted the pelt from the table. It glittered with yellow dust and spangles. Nuggets the size of grape stones—some as big as orange pips—nestled in the wool.

Croesus caressed the shining treasure. He thought: "How much luckier I am than Midas! The fleece turns to gold for me *before* I touch it!"

A Golden Fleece! For a fleece like the one Croesus touched, the legendary Jason and his band of Argonauts fought monsters and faced the terrors of the open sea. The story of Jason's heroes in search of the Golden Fleece of Colchis is a brave tale of long ago.

The Argonauts took their name from their long ship, the *Argo*. The wonder of Greece, it had high sails and places for fifty oarsmen. The mast was a tall pine, the ribs were of oak, and the prow was made of wood from a sacred grove. The *Argo* answered to the touch of the helmsman like a horse to the bridle.

Jason, a tall and handsome youth, was eager to prove by great deeds his right to be a king. He led heroes from all of Greece in the quest, including the famous Hercules, son of the god Zeus.

Before sailing, the heroes made an offering to the gods of the sea. Perils and adventures awaited them once they left familiar scenes behind. To reach the land of Colchis and King Aeetes, custodian of the Golden Fleece, the Argonauts would have to risk being crushed by the Clashing Rocks and sail the full length of the Black Sea.

The voyagers passed these tests of courage and strength admirably. On their journey, too, they saw many strange sights—giants with six arms, women warriors called Amazons, men who would rather dig iron in dark pits than tend orchards and flocks, birds who let fly quills as sharp as needles. Then at long last they steered into the mouth of a gold-bearing river and cast anchor in the harbour of Colchis.

Next day Jason and his companions told King Aeetes of their yearning for the Golden Fleece. They offered to serve him in peace or war to pay for it.

The king was angry. He valued the fleece more than his own life and had no thought of turning it over to strangers. But, being crafty, he spoke pleasantly to Jason, saying, "Remember, the fleece is from a sacred ram. It is only right that one who carries it away should prove his heroism by hard tests."

Jason agreed, and Aeetes told him what he must do to win the Golden Fleece. "Two fire-breathing bulls with feet of brass graze near here on the Field of War. You must yoke these fierce animals to a plough and sow the field with dragons' teeth. These are seeds from which Earthborn Men will sprout, ready for battle. These warriors will turn their swords on you. If you can conquer them single-handed, the Golden Fleece is yours."

"It is my destiny to strive for the Golden Fleece even though I perish," replied Jason. So a day was set.

The king's daughter, Medea, listened to all this. She knew the tests were beyond mortal powers and were designed to send Jason to his death. Medea looked through her white veil at the handsome stranger and was moved to help him, for she knew many spells. She sent a messenger to the ship and met Jason at a temple. There she placed a magic ointment in his hands.

"On the day you face the fiery bulls and the Earth-born Men, anoint yourself with this. Place it also on your lance and shield and sword. No blade can cut you, no fire can scorch you," said Medea.

A great throng was at the Field of War on the day of the tests. Then Jason strode to the plough, swinging his lance and his shield. Clouds of smoke rose from the lair of the bulls. The brass-footed animals came out, bellowing and clanging. Tongues of fire shot from their nostrils. The Argonauts trembled for Jason.

But Jason met the charge without flinching. He thrust the lance into the ground and seized the first bull by the horns, though surrounded by flames. Quickly he kicked the brazen foot and forced the beast to its knees. Jason let the shield dangle on his back, seized the other bull with his left hand, and brought him to the ground. Then he dragged both animals to the plough, fitted the yokes to their necks, and fastened the shaft.

The Greeks gave cries of joy. Even King Aeetes was filled with wonder at Jason's strength.

A man brought Jason a golden helmet filled with the dragons' teeth. The young hero ploughed the sod of the Field of War and dropped the sharp teeth into the furrows. He filled the empty helmet with water and drank deeply.

The Earthborn Men began to rise out of the ground where Jason first ploughed. They tore themselves loose from the clods and made for Jason. But he cut them down with his sword. As more and more Earthborn Men came on, Jason laid about him on every side. The whole field came alive with armed men. Then Jason did as Medea had told him and picked up a huge stone.

It was four times heavier than any stone most men could lift, but Jason cast the boulder far into the ranks of the warriors. Immediately they stopped their march against him, and turned on one another instead. When the fight was over, not one was left alive.

The Argonauts built a great fire at their camp by the ship and made a feast in praise of the brave Jason. But that night in the city King Aeetes was angry. He gathered an army to set fire to the *Argo* and kill all the crew. Medea hurried to warn Jason.

"You must sail tonight," she cried. "Come, I will guide you to the Golden Fleece."

The Argonauts left the feast and rowed to a dark grove. Medea led Jason to a tall oak. The fleece, gleaming in the darkness, was on the topmost bough. But coiled about the trunk was a dragon with crested head and eyes like burning coals. Medea and Jason came close. The creature stretched out his snakelike body and hissed frightfully.

Without fear, Medea crouched down and chanted a lullaby to the scaly monster. The hissing stopped, the coils loosened, the dragon grew drowsy. Then Medea sprinkled magic dew into the burning eyes. They closed for the first time in sleep, and the head slipped to the ground.

Jason climbed up and seized the Golden Fleece, came down and wrapped it about Medea.

"One treasure inside another!" he exclaimed. "Without your magic, my strength would not have been enough."

Jason returned proudly to Greece with Medea as his wife.

There must have been times when Croesus wished he owned a dragon to help him guard his gold.

People were always wanting gold from Croesus. He was no miser and gave generously for worthwhile purposes. But nothing could stop the worry that someone would try to take away his gold.

Croesus heard more talk than he liked about

Cyrus the Persian. Travellers from the East were full of stories of this young king. Only a few years before, Cyrus had been a boy herding goats. Now he was a great warrior and ruler of the Medes and Persians.

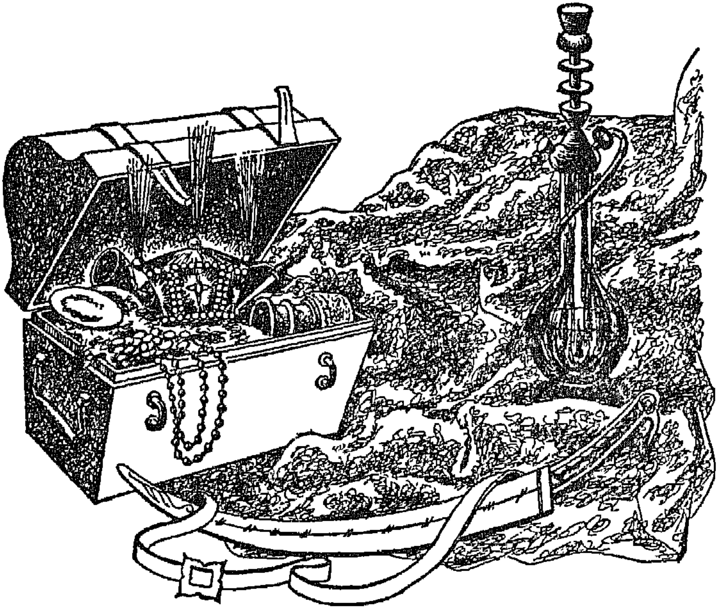
The victories of Cyrus made Croesus uneasy. He knew the time would come when this man would look with hungry eyes on his gold. Should he wait until the Persian made war on Lydia, or should he fight Cyrus now before he became stronger?

Uncertain what to do, Croesus sent messengers bearing gifts to the Oracle at Delphi. Among the presents were the golden lion, many golden bricks, the statue of the woman who baked his bread, even his wife's girdles and ornaments. He wanted the advice he got to be the very best.

Never before had the temple received such splendid offerings. Croesus was made an honorary citizen of Delphi, a rare honour for one not Greek. Then the king's men asked the Oracle whether Lydia should wage war on Cyrus.

The priestess went into a deep trance. Then she spoke in the name of Apollo. "Tell the king," she said, "that if he makes war on the Persians he will destroy a great empire."

This was what Croesus wanted to hear. He made ready for war. A counsellor tried to change the



king's mind. "The Persians," he said, "have nothing. They wear leather trousers. They eat whatever they can find and have no figs or other dainties as we do. What can you take from them? Nothing. But they can take everything from you."

Croesus would hear none of this. He led his army deep into Asia Minor and fought a battle with Cyrus. Neither side won. So Croesus returned to Sardis to collect a larger army.

This time it was Cyrus who did not wait. He forced battle on the Lydians outside Sardis, then besieged the city. Two weeks later the Persians broke through the walls and swarmed into the palace. Croesus stayed with his gold until the last. He became the prisoner of Cyrus.

The conqueror, so the story goes, ordered Croesus to die by fire. Soldiers piled up the wood and set the blaze. The flames rose. Then Apollo, or so Croesus believed, sent a rainstorm and put out the fire. This made Cyrus have a change of heart and he spared Croesus' life.

By now, bands of Persians were roaming the streets. They broke down doors, carried off booty, and set fire to what was left.

"What are your soldiers doing?" Croesus asked Cyrus, though he knew very well.

"They are looting your city," Cyrus chuckled.

"No, it is your city they are looting, O mighty Cyrus. It no longer belongs to me."

The more Cyrus thought about this remark, the wiser it sounded. He halted the destruction and later made Croesus his counsellor.

Cyrus went on to conquer new lands. When he took Babylon a few years later, he let the Jewish people return to Jerusalem and rebuild their temple. The Persian king ruled over many lands as Cyrus the Great.

Just as the Oracle had foretold, Croesus, by making war on the Persians, destroyed a great empire—his own. He was so anxious to save his gold that he forgot to ask whose empire the Oracle meant.

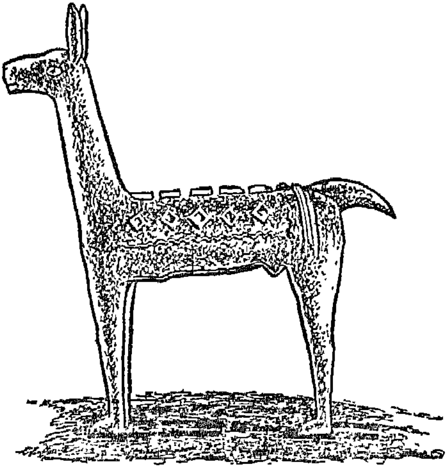
3: GOLD FROM THE SPANISH MAIN

ROMAN generals in the time of the Caesars loved to ride through the streets with the loot of war. The proudest displays of these victory parades were shining bars of gold.

Gold came to Rome not only as battle plunder but as tribute from conquered peoples. The chief gold mines were in Spain and Egypt, where slaves wearing lamps on their foreheads loosened the ore with hammers and picks. They had to crawl on their knees to do their work, for the tunnels were only about three feet high. Some of the slaves were small children who could stand upright and pass the pieces of hard rock from one to another. Outside, women and old men crushed the ore and ground it to powder, so the gold could be captured with running water.

Gold poured into Rome, but it poured out too. Wealthy Roman ladies liked to dress in silken garments. So gold went to India, Arabia, and China to pay for the silk.

Later on, Roman gold trickled away in another direction. The German tribes in the north heard stories of the great empire where life was so



pleasant. They began to invade Roman territory and carry away gold as booty. German war chieftains used the gold for buckles, and mounts for their gear, and huge drinking bowls. When they died, these golden treasures were buried with them.

Gold was very scarce in Europe between Roman times and the discovery of America. For a long time the only gold coins were bezants from Constantinople, where trade with the Far East still flourished.

Gold bezants circulated in Europe among rich merchants, but ordinary people seldom saw anything bigger than a silver penny. Only in churches could they really feast their eyes on gold. Here gold enriched the altar and gilded the haloes of saints in the holy pictures. Monks who were skilful gold-

A goldsmith at work in India

smiths made chalices and crosses, containers for holy relics, and robes for the bishops, decorated in gold.

Fame and fortune awaited anyone who could find a way to win gold. If only there were some way to turn cheap metals, like lead, into gold! Scholars puzzled over old manuscripts, hoping to find the secret of how to make gold in the wisdom of ancient times. Others studied the art of alchemy under Arab teachers. The alchemists believed that if they tried hard enough they could change base metals to gold.

The workshops of the alchemists were places of mystery in Europe for several centuries. They contained furnaces and crucibles, mortars and pestles, and flasks, beakers, and stills of blown glass. Today these are familiar objects in any laboratory. But they seemed so strange in the Middle Ages that alchemists often worked in secret lest they be accused of practising black magic.

Alchemy shops had signs and symbols about with secret meanings. One of these might show a green lion swallowing the sun. The lion stood for an acid, aqua regia (royal water), that can dissolve even gold, the metal of the sun. A snake swallowing its own tail stood for an endless circle. It reminded the alchemist to be patient: endless toil was necessary to make a base metal eat away its baseness—as the snake eats its tail—and draw closer to gold.

Alchemists mixed up some ideas that we try to keep separate. We know that plants grow from seeds but we do not think for that reason that stones do too. An alchemist reasoned that stones must grow sometimes, or else how do stalactites form in limestone caves? All that was necessary to make something grow, he believed, was the proper seed.

A grain of wheat decays, then sends up a shoot and produces many grains of wheat. The alchemist thought that gold deposits in the earth must grow from some precious seed. He called this seed the Philosopher's Stone and spent his life looking for it. If he could find it, he could make gold grow in the soil of base metals.

Alchemists toiled in fumes of sulphur over crucibles and retorts. They tried to drive away the qualities that made other substances unlike gold. They thought of these qualities as spirits of one kind or another. Spirits made bread rise, a magnet pull iron, and vapours condense in a still. To this day we speak of spirits of salt and turpentine.

No matter what the alchemists did, though, they were never able to turn base metals into gold. But they learned much about acids, medicines, and materials for making gunpowder. The real facts they learned became part of the modern science of chemistry.

Meanwhile, the search for gold went on in other ways. Kings and dukes offered rewards to anyone who found gold. In those days, men who tilled the fields were unfree serfs, but those who found gold often gained their freedom to come and go as they pleased. They had a share in their discoveries and did not have to pay taxes or fight in wars.

The time came when towns grew rapidly and shops offered tempting wares from the East. In the thirteenth century, Marco Polo came back from China with stories of the fabulous wealth of the Great Khan. But people wanted to find easier ways of reaching the distant lands where gold was plentiful.

One of these was a sea captain named Christopher Columbus. He concluded, after much study, that the world was round, although many people thought it was flat. If this were so, ships could sail west beyond the rim of the known world to China and the Indies, where there was gold enough for all one's heart desired this side of paradise.

Columbus could not know that between Europe and China there was a New World, also rich in gold.

Many people in this western world were mining gold and working it into jewellery centuries before the Europeans came.

High in the Andes, near Bogota, Colombia, is a lake of gold. It looks like other lakes, for the gold lies in the mud at the bottom. We know the gold is there because a few golden ornaments have been fished out. Gold-seekers have spent fortunes trying to drain the lake, without success. No one knows how much gold lies below the water. It would cost so much to get the gold that no one now tries to take it from the place where it has been lying for hundreds of years.

There is an old Indian story that a certain tribe made a yearly sacrifice of gold to the goddess of this lake. As the sun rode high on the appointed day, a holiday crowd would gather on the shore.

Suddenly the people became still and turned their eyes towards the chief of the tribe. Covered with gold dust from head to toe, the chief stepped on to a raft. Those near by could sniff the pine-scented resin that made the gold cling to him.

The raft moved to the centre of the lake. The chief stood with uplifted arms. His body flashed in the noonday sun. Attendants handed him trays of emeralds and golden jewels and he threw the treasures into the water. After the sacrifice, the chief plunged into the lake and came up, washed clean of gold. As he swam for shore, the people shouted for joy and threw their own offerings of rings and bracelets into the lake. Then for hours they danced and sang in honour of the goddess.

From this ceremony, or others like it, grew the glamorous legend of El Dorado, the Gilded Man, who was supposed to live in a region so rich in gold that he covered his body with it.

The Indians of what is now Colombia, in South America, hammered cold gold and cast molten gold into beautiful shapes more than a thousand years ago. Gold lay in the streams that rolled down from crags where condors—large vultures—built their nests. The use of gold in the Americas probably began here. More gold still comes from Colombia than from any other South American country.

Gold was the first metal man worked in the New World—just as in the Old World. The art of working gold was too good a secret to keep. It spread south from Colombia along the terraced slopes of the Inca country and reached the Araucanians in the forests of Chile. And it spread north into Central America and Mexico.

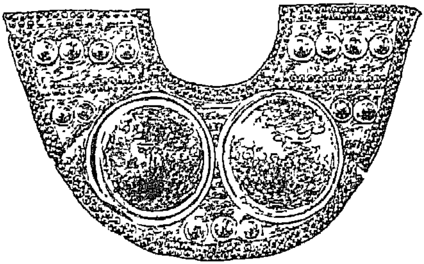
The Mixtecs in southern Mexico were exquisite jewellers long before the time of Columbus. To make a jewel they first modelled a design in clay and covered it with a thin layer of wax from wild bees. They packed powdered charcoal and mud over this and left openings into the wax. Then they put the object into an oven to bake. When it came out, the clay and mud were hard, the wax had melted away. The goldsmith poured molten gold into this shell. It cooled, and when he broke the shell he had a fine golden jewel.

Hundreds of such jewels lay buried in tombs until they were found in the present century. People who go to Mexico can visit the museum in Oaxaca to see them.

Even today, the workmanship can hardly be equalled. One of the golden jewels is a lifelike mask of the "old father of the gods." The sunken eyes, the scraggly beard, and the grinning, toothless mouth show up in finest detail.

The most popular objects among visitors are the many-shaped golden rattles. One is in the form of a feathered bat with open mouth and staring eyes. Some of the rattles have pebbles inside. They could be strung in the doorway, so that people then knew when visitors called. Sometimes a girl fastened rattles to her bracelets. Then she made music where-ever she went.

Indians on the high plateau of central Mexico, where Mexico City now stands, admired the jewellery of the Mixtecs and learned how to work in gold, too. They mounted pearls and turquoise in



gold; and they worked gold into the many-coloured ornaments—for the head, ears, nose, lips, breast, and legs—and for the idols which adorned their pyramids.

Torches burned at night on those pyramids, and people danced in praise of Quetzalcoatl, the Feathered Serpent. Quetzalcoatl understood the mysteries of earth and sky. In the old days he had lived among the people and shown them how to grow beans, make pottery, and weave cotton cloth. Then he sailed off towards the rising sun but said he would return after many years and rule the land wisely.

The Aztecs brought a new god into the Valley of Mexico in the year 1325. A hungry, wretched band of wanderers, they settled on an island in a shallow lake, glad to have a home. Who could have dreamed that they would become the founders of the Mexican nation?

The Aztecs worked hard. They piled mud on matted roots along the shore and planted wheat and vegetable seeds. Soon they had floating gardens, which they tended in canoes. As the roots anchored on the bottom of the lake, the gardens stopped floating and the island grew larger. The Aztecs built stone causeways, with drawbridges, to link it to the shore.

Mexico City, as it was later to be known, grew from a village of adobe huts into a city of pyramids, temples, palaces, plazas, markets, and schools. An entire neighbourhood was devoted to the homes and shops of the goldsmiths. Boatmen paddled into the city with fruits, corn, and fish. Burden-bearers trotted over the causeways with tribute in cotton, honey, chocolate, shells, cloaks, and feathers. Sometimes the tribute was a jaguar or a mountain lion for the zoo, or some eagles and parrots for the aviary. Sometimes it was salt, copper, silver, or gold.

Gold came as dust in bird quills and as yellow bars. The palaces of Mexico City were bright with gold and rich in jade. A green jade stone was worth more than a great load of gold. Or so the Aztecs thought.

When Montezuma was ruler of the Aztecs in the

sixteenth century, a strange vision of floating towers with great white banners appeared on the water of the eastern sea one day and did not disappear. Aztec officials saw it with their own eyes. They also saw men with heavy beards and skin as white as plaster come ashore and set up camp.

Believing that Quetzalcoatl had returned to claim his throne, Montezuma selected many precious gifts for the strangers. Among them were a golden bow with ten arrows, many gold collars, and golden figures of monkeys, wildcats, and tiny hairless dogs. The most dazzling present was a sun disc of gold, big as a cart wheel, bearing the signs of the Aztec calendar.

Burden-bearers carried the gifts over the mountains to the coast. They came back with news that the gods insisted on paying Montezuma a visit and were actually on the way. In a last effort to head the strangers off, the great chieftain sent them more jewels and a helmet full of grains of gold. But nothing satisfied their appetites. Montezuma's messengers reported the words of the chief, who called himself Hernando Cortés.

"Tell your lord," he said, "that we Spaniards suffer from a disease of the heart for which gold is the only cure."

Gold mace head

The strangers drew closer. Worse still, they won allies along the way among those who owed tribute to Montezuma. Warriors from enemy tribes joined the march to take revenge on the Aztecs.

"I can make war on men, but how can one make war on gods?" Montezuma asked his priests and warriors.

A young warrior named Cuauhtemoc spoke up. "Perhaps the strangers are not really gods," he said. "Then, unlike gods, they will die when cut. So will the animals they call horses."

Some agreed with Cuauhtemoc. They said the strangers were fewer than four hundred and should be destroyed at once unless they left the country.

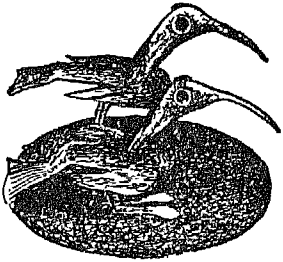
But Montezuma would not take this bold course. He reasoned that if Cortés were really Quetzalcoatl, no one could hope to resist him. If he were a man, the great city had nothing to fear. The Aztecs could watch him, load him with gold, and send him on.

So the Aztec and Spanish leaders met under a bright canopy on the southern causeway and exchanged greetings and presents. Cortés received a garland of flowers and a necklace of finely wrought golden crabs. His gift to Montezuma was a string of glass beads.

Montezuma made his guests comfortable in the palace where his father had once ruled. In this palace there was a secret chamber containing his father's treasure.

Then the Aztec ruler showed Cortés and his men his own palace with its wealth of gold and jade. He heaped still more gifts on the Spaniards and conducted them through the city. They saw the great market with stalls where gold, precious stones, and feather mantles were on sale, along with chickens and ducks, jugs and vases, nut butter, tobacco, paper, copper axes, and a thousand other things.

The visitors climbed 114 steps to the top of the Aztec War God's pyramid. There, behind the altar, the War God stood—a tall stone figure with horrible eyes and wearing a necklace of human hearts and faces. Gems covered the body, and a girdle of golden snakes circled the waist.



Gold disk from an Inca ear plug

Everywhere Montezuma took the Spaniards, they seemed to be interested only in gold. One day a servant brought him a report on the behaviour of his guests. They could even *smell* gold, the servant said, for one of them had broken into the secret chamber where the treasure of Montezuma's father was kept. Piled high inside were slabs and plates of gold. The Spaniards had rushed in, admired the gold, felt it, then had stolen out and sealed the room again.

When Montezuma heard this story, he began to understand how hungry the strangers were for gold. He secretly wished they would take it all—if only they would go away.

Soon after this incident, Cortés and four of his captains called at Montezuma's palace. They were polite at first, but suddenly Cortés lashed out at Montezuma with angry words. Because they had heard that there was a plot afoot to kill them, the Spaniards made Montezuma a hostage in his own father's palace.

Anger and confusion swept through the city. Some wanted to choose a new chieftain. Others still hoped that Montezuma would find a way to get rid of the gold-mad visitors.

The captive ruler made one last effort to satisfy the Spaniards. He offered them all his gold and promised to become a vassal of their king. His proud spirit was broken. To make good his promise, he ordered his goldsmiths to bring all the gold thither.

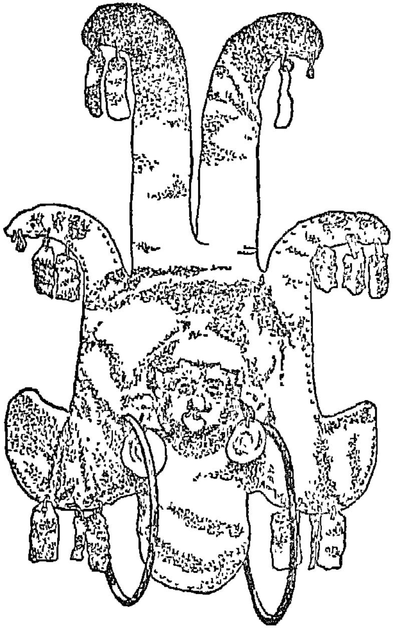
Down off palace and temple walls came the gold ornaments. Into the melting pot went Montezuma's jewels and the bars and plates from the secret chamber. The Spaniards looked on with greedy eyes. When all the treasure had been melted down, they had the goldsmiths pour it into broad bars and stamp it with the royal arms of Spain. Each bar measured three fingers of the hand across.

"It is worth six hundred thousand pesos!" exclaimed a Spanish officer. One fifth was to go to the king of Spain, another fifth to Cortés. And Cortés explained that there were also many expenses, so little was left for the ordinary soldiers.

Montezuma no longer wanted his freedom. He was more afraid of his sullen people than of the Spaniards. He did everything his captors wanted except one thing. They urged him to destroy the image of the War God. This he refused. To do so, he said, would cause an uprising in which they would all perish.

The Aztecs danced and sang to the War God in the square of the Great Temple each year on May 10. Before that date arrived, Cortés received news of the landing of more Spaniards on the coast. He went to meet them and left red-bearded Pedro de Alvarado in charge.

On May 10 Alvarado heard the blast of shell trumpets and the beat of war dances. Bristling with anger, he ordered the Spanish soldiers to form ranks. They marched from their quarters and covered the entrances of the square. At a command from Alvarado, they charged with swords. Scores of Aztecs died under their thrusts. Spanish muskets and cannon mowed down others. The festival turned into a massacre.



Cortés returned shortly after this to find the city in revolt. Angry crowds surged outside the Spanish quarters. Cortés chided Alvarado for his rashness. Then he sent Montezuma to quieten the people.

The unhappy chieftain stepped out on to the roof of his father's palace with Spanish guards at his side. He tried to speak to the crowd below.

A young warrior shouted, "This is not our chieftain but a scared woman who has sold us out to the Spaniards." It was Cuauhtemoc.

The crowd sent a volley of stones and arrows flying at Montezuma. He received three wounds and fled back into the palace. Soon after, he died.

Now there was nothing to hold back the wrath of the Aztecs. Warriors surrounded the palace.

The Spaniards tried to cut their way out on horseback. Some of the Aztecs fell under the horses' hoofs, but others slashed at the animals and mail-clad men with long lances. Javelins and arrows rained down on Cortés and his men from roof-tops. They got as far as the western causeway and drove many of their foes into the water. But finally they had to return to their quarters.

Cortés then resolved to slip away in the night. He ordered the treasure to be loaded quietly on to the horses. But there was more gold than the horses could carry, so he told every man to help himself freely to what was left. The soldiers fell on the gold with joy.

It was a dark, rainy night in June. A breach in the causeway might have prevented their escape, but the Spaniards carried a portable bridge to fill the gap. Cortés and the horsemen led the way and were safely over the bridge. Foot soldiers followed, staggering under the weight of the gold.

Suddenly a voice cried out. The beating of drums high in the temple spread the alarm. Warriors closed in on the Spaniards.

"Oh, villains, are you still alive?" they shouted.

Men struggled hand to hand in the rain. Blades of stone clashed with blades of steel. The bridge sank under the weight of horses, men, and gold.

Some of the Spaniards threw away their gold and swam to safety. Others held on to it and drowned.

Colombian gold pin

It was a sad night even for the Spaniards who got away. Most of the gold was lost in the water.

Cuauhtemoc became the chieftain of the Aztecs early in 1521. He put on the feathered mantle and the golden headdress. He pierced his arms with maguey thorns as an offering to the War God. Cuauhtemoc was twenty years old. It was his duty to defend Mexico, and he faced a hard struggle.

The Spaniards were on their way back. They had more men and arms than ever. They also had new Indian allies, for Cortés was promising the spoils of Mexico to all who would join him now.

Cuauhtemoc tried to make peace with the other tribes. He freed them from tribute and urged them to forget past enmities and join in the defence of Mexico. But it was too late.

The young ruler prepared for a long siege. He sent the women, children, and old people out of the city. He put men to work making darts, arrows, and lances. He deepened the breaches in the causeways. His warriors made many forays to attack the Spaniards and slow them down.

Nevertheless, the enemy managed to destroy the aqueduct that supplied the city with fresh water. After that there was only brackish water to drink.

Cortés made his first attack on the city itself by the same causeway over which he had fled on the sad night when he had lost so much gold. Cuauhtemoc's warriors fought him off with javelins and arrows.

Then Cortés retired to the lake outside the city and built a fleet of thirteen ships such as had never been seen before in Mexico. The attack with launches came along the southern causeway where Montezuma had once met Cortés in friendship. Spanish horsemen on raids destroyed many temples, including the temple of the War God. But some of them did not get back to their base. Aztec warriors cut off their escape by opening the canals behind them. Then they pushed the horses and armoured men into the water.

The siege lasted ninety-three days. Finally the Aztecs had nothing left to eat but the bark of trees. When all their land had been conquered, they took to canoes. Spaniards cruising the lake captured Cuauhtemoc and brought him before Cortés.

At first, Cortés honoured the young chieftain who had defended his city to the last. Somewhere in the ruins of the city, the Spaniards were sure, there was hidden a great fortune in gold. But the conquerors found very little treasure, and Cuauhtemoc said there was no more gold except what lay at the bottom of the water.

Had the Spaniards shed their blood for such a small reward? They complained bitterly to Cortés.

"Where is Montezuma's treasure?" demanded the Spaniards, as they pressed burning irons against the flesh of Cuauhtemoc and two of his captains.

One captain turned his eyes to Cuauhtemoc as if begging permission to talk. Cuauhtemoc shot back a scornful glance and said, "Do you think I am enjoying a pleasant bath?"

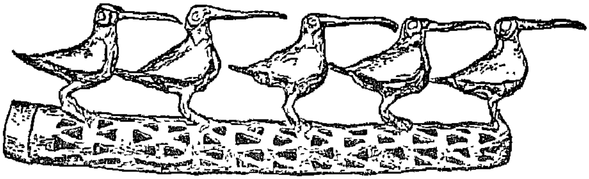
Cuauhtemoc's companion died under torture with his lips sealed. Cuauhtemoc walked with a limp after the torture and later Cortés had him hanged from a tree.

And no one is sure to this day what happened to Montezuma's missing treasure.

All too often, as the Indians learned, the men from beyond the sea loved yellow gold more than peace. A chief in Panama came upon some Spaniards quarrelling over gold.

"If it is gold you want," he exclaimed, "I can tell you of a country where even common things are made of it. It is six suns away on another sea."

Among those who listened was the Spaniard Francisco Pizarro. Pizarro led his men into the land of Atahualpa, the Great Inca. It was a country of abundance with roads and bridges, towns and inns, and irrigated mountain valleys. Pizarro had a daring plan to seize the Great Inca himself—the man who ruled the country.



The opportunity came in 1532, when the Inca received the Spaniards in the town of Cajamarca in

Peru. Pizarro gave a signal to his followers. There was a roar of cannon, and the horsemen charged. Some of the Spaniards cut down Atahualpa's bodyguard. Pizarro himself seized the startled Inca. It was a surprise attack. Some two thousand Indians died from gunpowder and cold steel.

Atahualpa's robe, torn in the struggle, was richly worked in gold. His wrists and fingers blazed with gold. The Inca offered Pizarro a great king's ransom for his freedom. The room where the Spaniards kept him prisoner was twenty-two feet long and seventeen feet wide. Atahualpa promised to fill it with a ransom of gold as high as he could reach. He sent out the order to ransack Peru for gold.

Ransom gold came from the Temple of the Sun at Cuzco and from every corner of the nation—cups and vessels, figures of birds and animals, basins from palaces, and panels from temple walls, all of gold. The Spaniards melted it down and weighed it out as 1,300,000 pesos, or fully seven million pounds as we value money today.

But Atahualpa did not win his freedom for this king's ransom. Pizarro found an excuse to put him to death. Then he went on and conquered all of Peru.

By this time the Spaniards knew the story of El Dorado, the Gilded Man, and searched for him through the forests and swamps of northern South America. Many died of fever but no one found the Gilded Man. Other explorers looked for Manoa, a city with streets of gold on an island in a great inland sea. But no one could find the Golden City either.

There were no more Montezumas, no more Atahualpas. But for those with eyes to see, there was still a rich New World to conquer.

And there was a hundred times more gold than Cortés and Pizarro won, but it lay in undiscovered mines, and you could not dig it up with a sword.

The Spanish treasure ship of 1579 was on its way from Peru to Panama, riding low in the water. Master San Juan de Anton checked over the cargo. Everything was in its place—jewellery, precious stones and pearls, eighty pounds of gold, twenty-six tons of silver bars, and thirteen chests of silver pieces of eight.

The cargo of a Spanish treasure ship belonged partly to the king and partly to private persons. Mule trains waited in Panama to carry the treasure across the Isthmus, on the Gold Road, to the Spanish Main. Here, on the mainland of northern South America, it went aboard another ship. Armed galleons convoyed the treasure from this point. They stopped at the fortress of Cartagena to take on many yellow bars of gold. At Havana they joined the treasure fleet from Mexico, for all the gold and silver crossed to Spain in a single convoy. The king breathed more easily when he heard of its safe arrival, for many of his enemies sailed the Atlantic.

Master San Juan felt safe on the Pacific. The king's enemies would have to brave icy storms round the tip of South America to catch him up. He thought little of it when a ship crossed his course and came alongside.

"Who are you?" he called.

"Englishmen," came the surprising reply. "Strike sail!"

The Spanish captain saw a deck full of armed men.

"Strike sail, Master San Juan de Anton," their leader cried, "or you will be sent to the bottom."

"Come on board and strike the sails yourself," San Juan dared him.

The Englishman blew a whistle. A trumpet sounded. Shot and arrows flew into the side of the treasure ship. Chain balls from an artillery piece carried away a mast and sail. San Juan bore to port, but a small launch laid to and forty English archers made ready to board.

So San Juan had to strike sail and surrender. He went aboard the English vessel as a prisoner, along with his passengers and crew. The vessel, they saw, was the *Golden Hind.*

Colombian gold pin

The English captain took off his helmet and mail and placed a hand on Master San Juan's shoulder, saying, "Have patience. This is the way of war."

The Englishman was of medium height with reddish-brown hair and beard. He introduced himself as Francis Drake and called a steward.

"See that Master San Juan is made comfortable and seated at my table," he ordered.

Next morning Drake asked for the cargo list of the captive ship. For three days the English crew moved back and forth in the launch between the two vessels. They loaded all the gold, silver, and jewels aboard the *Golden Hind* and helped themselves to some canvas and tackle for good measure. Drake gave San Juan a receipt for everything. He made a special point of finding out which part of the cargo belonged to the king of Spain.

"The silver I take from the king is for myself," explained Drake. "The rest is for my sovereign lady, the queen." He said he was collecting a debt from the king for losses he had suffered in an earlier sea fight.

San Juan was astonished at the luxury aboard the *Golden Hind.* The finest linen covered the captain's table, and the silver dishes carried Drake's arms in gold. Violinists played during dinner, and afterwards Drake liked to pass round almonds and candied fruits and tell about his voyage.

He had sailed from England with five ships, but the other four had gone down or disappeared from sight in terrible storms below South America. The *Golden Hind* had fought freezing gales for two months to reach the Pacific. But then its crew had sailed boldly up to Valparaiso, boarded a Spanish vessel, and seized a cargo of Chilean gold. They had followed the coast north, captured other prizes, and outsailed all their pursuers.

Every evening Drake conducted religious services in the poop of the vessel. He read psalms and led in hymn-singing but did not make his prisoners take part, for they were of a different faith.

One day Drake remarked to San Juan, "You will say, 'This man is a devil, who robs by day and prays by night.' This is what I do. But just as King Philip gives a large paper to your viceroy, telling him what he is to do, so Queen Elizabeth has ordered me to come to these parts. It is she who knows best. I am not to be blamed for anything I do."

After a week he let the captives return to their own ship and go where they pleased. But first he gave each of them a little money and other presents.

Drake handed the Spanish captain a note ordering that, if other English ships met him, they were not to rob him a second time. Then he bade his guests goodbye, a safe voyage, and better luck next time.

The *Golden Hind* sailed farther north after the raids on the Spaniards. In a vain attempt to find a sea passage through North America that would take him back to England, Francis Drake was driven in a storm to the California coast near San Francisco Bay.

There was more gold in California than in Peru. But Drake did not know it, and the California Indians, unlike those farther south, placed no value on the yellow pebbles they saw glittering in the beds of streams.

Nevertheless, Drake claimed the land in the name of his queen. Then he crossed the wide Pacific, traded in the East Indies for spice, sailed round the tip of Africa, and came home after three years. The *Golden Hind* became the first English ship to sail round the world. As a result of his splendid deeds, Francis Drake was made a knight by Queen Elizabeth.

Every nation wanted a share of the Spanish gold. Kings needed gold to pay for their wars. Noblemen wanted to set a fine table and enjoy the luxuries of the Old World and the New World. Merchants wanted to live like lords, wear ruffled collars, and buy more ships. Their wives wanted cloth from India in place of homespun wool.

There was four times as much gold and silver in circulation in 1600 as there had been when Columbus discovered America. But beef cost four times as much, so poor people wanted more money too. Many a boy went to sea with dreams of gaining wealth from the Spanish Main. Spain seemed like fair game for plunder. Why should one country have the right to half the world's riches?

The water of Spanish America swarmed with seadogs who called themselves buccaneers. Spain called them pirates. They were not all as polite as Francis Drake.

The buccaneers used light boats that were swifter than the Spanish galleons, though no match for them in arms. These small, quick-moving vessels hovered on the skirts of the treasure fleets and watched for stragglers. If a heavily loaded Spanish

A famous gold salt-cellar made by the Italian artist Benvenuto Cellini

merchant vessel fell behind, the fast sailers were upon it like wolves. They cut it out of the flock and carried it away as a prize.

Buccaneers were skilful in disabling and boarding a ship that put up resistance. They sent out their best marksmen in canoes to pick off the man at the helm or anyone who took his place. Meanwhile, another raiding party came close under the stern of the treasure vessel and wedged up the rudder to put it out of commission. Once a canoe got close to the ship, it was out of reach of the big guns. The attackers could riddle the canvas or set fire to powder jars on deck.

By this time, the Spanish crew might be ready to ask for quarter. If not, boarders climbed over the sides with bloodthirsty cries. Then they fought it out on deck, hand to hand, with knives.

The buccaneers called themselves the Brotherhood of the Sea. Many pirate ships, with hundreds of men, sometimes joined in company. But even then, they were not strong enough to plunder a whole Spanish treasure fleet. Nothing but a squadron of warships could hope to do this.

Only three times did the king of Spain lose an entire convoy. In 1628 Admiral Piet Heyn of the Dutch West Indian Company captured the treasure fleet from Mexico and carried the rich booty to Holland. Twice, in 1656 and again in 1657, Admiral Blake's English squadrons lay in wait near Spanish waters and plundered the treasure ships as they were almost home.

The English seized the Spanish island of Jamaica about this time. It became a favourite haunt of sea-rovers. They made their boats ready in Jamaica, set out from there on raids, and came back to the island to sell their loot.

Of all the sea-dogs who sailed out of Jamaica the most daring was Henry Morgan. He was not satisfied to take treasure ships but raided cities on the Spanish Main as well. Morgan commanded hundreds of fighting men, who landed by surprise, plundered the inhabitants, and demanded a ransom to spare the city from the flames.

Once Morgan proposed to take the great fortress of Porto Bello with nine ships and 460 men. Porto Bello, the treasure port in Panama, was at the Atlantic end of the Gold Road across the Isthmus.

"The fewer the men, the more the spoils," thought Morgan.

His fleet approached Porto Bello by night. Lookouts saw two forts at the harbour entrance. Morgan's men crept ashore. They overcame the sentry at one fort and shouted, "Surrender or be cut to pieces!"

The garrison of the fort surrendered. Then the raiders set fire to the powder and blew up the tower. But the other fort held out until noon.

"I will never surrender alive!" cried the Spanish commander.

The attackers set fire to the doors. The Spaniards dropped pots of gunpowder on their heads. Many of the raiders died below the walls of the fort, but others mounted ladders and fired into the garrison.

Then, one by one, Morgan's men dropped from the wall into the fort. The Spanish commander killed many of them with his own hands. He fought to the end and died without asking quarter.

Porto Bello was a rich prize for Morgan's men. They plundered the city for two weeks. Much of the gold was in the ground or at the bottom of wells, where its owners had hidden it. But the raiders had a way of making it come to light. They captured all Spaniards of means and threatened or tortured them until they paid ransom.

After Morgan got all he could in this way, he demanded a second ransom.

"Bring me one hundred thousand pieces of eight or I shall burn Porto Bello to ashes," he warned. The inhabitants scraped together whatever was left and saved the city.

The Governor of Panama, at his palace in Panama City, was amazed that a small party could capture Porto Bello. He sent a messenger to ask for a sample of Morgan's arms. Morgan sent back a pistol, a few lead bullets, and a note that read, "Please accept these modest arms and keep them for a year. At that time I shall come to Panama and fetch them away."

The governor returned the pistol with another note. "Don't trouble to come to Panama," he wrote. "You will not fare so well as in Porto Bello."

Captain Morgan kept his appointment, but he was a little late. After a few years he marched on Panama City with twelve hundred men. It was a ten-day trip across the Isthmus to the Pacific side. One day there was nothing to eat but leather bags. The raiders soaked them in water, scraped off the hair, cut the leather into small pieces, and roasted it. The only way they could swallow their meal was with big gulps of water.

Finally Morgan's men saw the steeples of Panama City and broke into cheers. Untold riches in gold were close at hand. The governor must have known that this was Morgan's long-promised call, for that night lead from the city's guns poured into the raiders' camp.

Next morning picked troops marched out to destroy the raiding party. Ahead of the soldiers came a herd of wild bulls. The bulls were supposed to charge into the raiders' camp, trample on the men, and break their ranks. Fortunately for Morgan, the beasts ambled off in another direction and did no harm.

A pitched battle raged all day, but the garrison was no match for the ferocious raiders. By night, Panama City, with its mansions, churches, warehouses, and stables of gold-carrying mules, was in their hands.

Aztec gold breastplate

But the prize Morgan most wanted was gone. A galleon had just sailed away with the king's gold aboard.

The raiders burned the city in revenge. Most of the Spaniards were in hiding outside the city. Groups of raiders searched the countryside to bring them in. Anybody who looked rich had to pay ransom or suffer torture. The loot in gold and silver came to as much as 177 pack mules could carry.

While Morgan was spreading a trail of blood along the Spanish Main, an old blind English poet named John Milton was writing a new book about the struggle between good and evil. Milton imagined the Powers of Evil as fallen angels in revolt against God. The captain of these evil forces was Satan, but he had many lieutenants, for evil takes various shapes.

Milton gave the name of Mammon to one of the fallen angels. Mammon loved gold above everything else. He was stooped over from constantly looking for gold. Mammon saw none of the beauties of Heaven except "the riches of Heaven's pavement, trodden gold." After he was cast out into darkness, Mammon's first thought was to dig gold in his new home.

Milton said it was Mammon's example that taught mankind to rob Mother Earth of treasure. Men do so much evil in their greed for gold, the poet thought, that it would be better for the gold to stay in the ground.

Milton was right that greed is at the root of man's inhumanity to man. But the greed is in man and not in the gold. The gold from the Spanish Main did much good as well as evil.

Gold put money into the hands of far more people than ever lived in Croesus' world. Not all the Spanish gold changed hands by robbery. Much of it came to France and England in honest trade to pay for manufactured goods. The lanes of commerce carried gold and silver coins throughout Europe.

People often left gold with goldsmiths for safekeeping. Goldsmiths' shops sometimes grew into banks, and out of the development of banks grew new forms of money.

Gold helped the people of Europe to find better ways to do things. The use of coal and iron was expanding. Mines were dug deeper than ever before. Water had to be pumped out of them; thus, the steam-engine was invented. It was only a step from coal, iron, and steam to railways, steamships, and great industries. Gold paid for many of these things and opened up new jobs and new business opportunities.

4: FAMOUS GOLD RUSHES

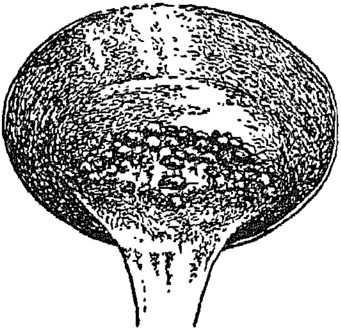
Below the pine-covered slopes of a California mountain valley, a white man and an Indian tugged a whipsaw back and forth over a big tree trunk. The time was January 1848.

They paused to wipe away the sweat. Sawing out boards is hot work even in winter. The white man pointed to a new wooden building and a ditch that cut across a loop in the river.

"Pretty soon now, sawmill ready. Then we make river saw boards. We rest," he said.

"Hard work for river," said the Indian, laughing. He was used to white men's fooling. True, they had strong magic in the black powder that tore up rock and made the river flow into a new bed. But a magic saw, able to cut timber without making a man's muscles ache—that was too much to swallow!

The pair at the whipsaw noticed some excitement by the mill. They walked over and joined a group that was forming round James Marshall, a bushy-haired, black-bearded foreman. Marshall held a white Mexican hat in his hand. Everyone looked at a dent in the crown. In it was a little pile of gleaming yellow grains.



"Boys, I think I have found a gold mine!" Marshall exclaimed.

Excitedly, a workman pulled a five-dollar gold piece from his pocket. It was from his soldier's pay. Like most of the others, he had served in the Mormon Battalion in the recent Mexican War. He balanced the coin in one hand and some yellow flakes in the other. Both seemed heavy.

Another man bit into a flake of the yellow stuff. It was soft enough to show tooth marks, but it didn't break.

"It must be gold!" he shouted.

"We'll be rich" cried another ex-soldier. "How lucky we stayed in California for the winter instead of leaving for Salt Lake City right away."

Marshall told his story. "I was walking along the tailrace below the mill. The water was turned on to carry away the loose dirt and deepen the channel. I

saw something glittering in about six inches of water and waded out to get it. Then I saw other pieces. I told a couple of the boys to shut off the water. Now look what I've found!"

The Indian exchanged glances with some of his people who had worked in a Mexican mine farther south.

"Oro," they murmured, using the Spanish name for gold. Soon the Indians wandered back to work. The streams were full of bright pebbles. But could you eat them? Could you make them into a blanket so

that the rain would run off your shoulders and you would stay dry?

All the white men could think about, though, was whether the yellow flakes were really gold. They dipped them in vinegar and saw that they did not tarnish. They got Mrs. Wimmer, the cook, to drop a lump into the lye pot where she was making soap. It stayed in for hours and came out unharmed.

This is how gold was discovered on January 24, 1848, at a place now called Coloma on the South Fork of the American River. California was still a part of Mexico then, but a peace treaty had already been signed with Mexico and it became United States' soil nine days later.

On January 28, Marshall made his way down the valley in a heavy rainstorm to the meeting place of the American and Sacramento rivers. Here was Sutter's Fort, headquarters of the vast properties of Marshall's boss, Captain John Sutter.

Marshall entered the stockade and burst into Captain Sutter's offices.

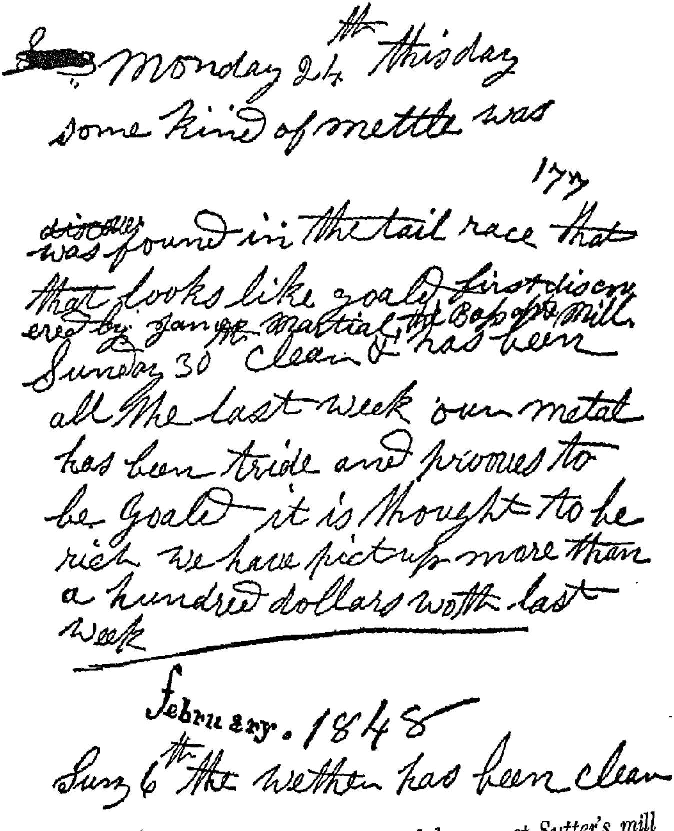
"I must see you alone," he said. Sutter, elegant with goatee and long black coat, saw a wild look in the eyes of the man with dripping clothes. He led the way to his living quarters.

"I need a pair of scales and two bowls of water," said Marshall. When he had them, he made sure the door was locked, drew a rag from his pocket, and untied a pile of gleaming sand.

"I believe it is gold," he said.

"Impossible!" exclaimed Captain Sutter.

"Let me have some silver and we'll see."



[illegible] Monday 24th this day
some kind of mettle was
177
~~discover~~ ~~was~~ found in the tail race ~~that~~
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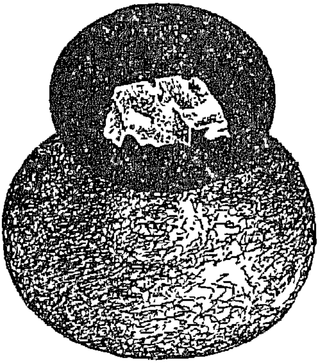
ered by James ~~M~~ Martial the Boss of the Mill.
Sunday 30 clear & has been
all the last week our metal
has been tride and proves to
be goald it is thought to be
rich we have pict up more than
a hundred dollars woth last
week

February. 1848
Sun 6th the wether has been clear

Part of an entry in the diary of a labourer at Sutter's mill

Sutter pulled out three silver dollars. Marshall put them into one pan of the scales. Into the other went yellow dust until the scales balanced. Then he lowered both pans into the water. The silver shot up, the yellow grains sank.



The first nugget found at Sutter's mill in 1848

At this, Sutter sat up and took notice. He reached for a hammer and pounded one of the grains. Instead of splintering like pyrites—fool's gold—it flattened out. When he put it in nitric acid it did not stain.

Gravely the captain said, "I believe this is the finest kind of gold."

The lives of the two men were never to be the same again. Marshall, a carpenter from New Jersey, left in the rain, his eyes afire with visions of gold. Many were to become rich from his discovery. But what Marshall could not yet know was that he was among the even larger number who would never find much gold.

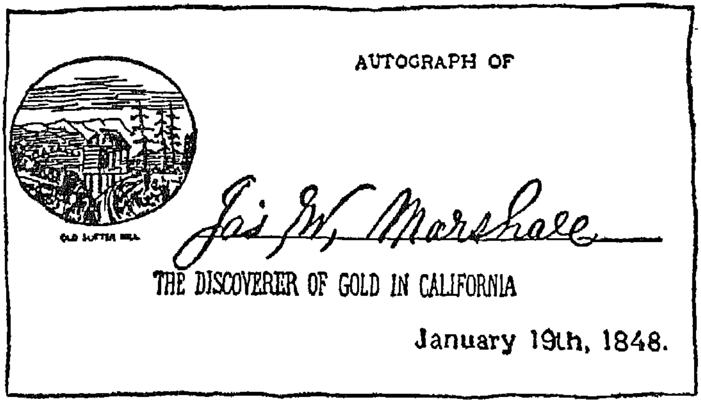
Sutter sat deep in thought. Many years before, he had left Switzerland as a poor soldier of fortune. Now he had thousands of acres of pasture for cattle and horses, besides orchards, wheat fields, and the timber lands where the sawmill was going up. He sent his river boats to San Francisco. Sutter's Fort was a town in itself, with shops, a bakery, a blacksmith's forge, a tannery for leather, and looms for blanket-making. Americans stopped and found a welcome here as they crossed the Sierra and entered California. Sutter seemed like a king to his friends back in Switzerland.

Now there was even gold in Sutter's kingdom. But news about gold could be upsetting to this kingdom —unless he kept it a deep secret.

Sutter visited the sawmill and asked the men to stay on and finish the job. He doubled their wages and begged them not to say a word about the gold.

But there is one secret men seem not to be able to keep, and that is the discovery of gold.

One man, then another, sent word to some friend with whom he had served in the Mormon Battalion. A teamster called with supplies and found the men slipping off after work to the stream. He saw them prying gold from the rocks with their knives. Naturally, he filled his own pouch full of gold. He spent the dust at a shop, and the word passed along to San Francisco.



AUTOGRAPH OF

Jas W. Marshall

THE DISCOVERER OF GOLD IN CALIFORNIA

January 19th, 1848.

More gold strikes followed, up and down the stream. The miners learned to put gold-bearing gravel into a tightly woven willow basket, lower it into the water, and swish it around. The lighter pebbles slowly washed away until only gold remained in the bottom, mixed with black sand.

From baskets the miners turned to frying pans. Later they used deeper pans, without handles, especially made for gold. While panning, they stood two feet deep in the stream. The water was icy cold from the melted snow of the mountains.

A miner who had dug gold in Georgia happened to be in California. In March he came to the diggings and set up a sort of cradle, or rocker, about three feet long, on the dry shore. You shovelled the gravel into a hopper at the head of the cradle. The finer particles passed through a sieve to the floor. Then you poured in water and shook the cradle until the sand washed away. Gold settled on the bottom, where wooden cleats caught and held the pieces.

A cradle was faster than a pan. People came from all over to see it. There was a lot of excitement. Nevertheless, the Mormons finished the sawmill for Captain Sutter. And, much to the astonishment of the Indian at the whipsaw, it really did saw out boards. So the white men were not fooling after all!

For hours the Indian lay on his stomach, watching the waterwheel turn the machinery that saved so much drudgery. While he looked at the wonderful saw with lazy, loving eyes, white men close by were digging, shovelling, and swishing away for their very lives.

A San Francisco paper printed a rumour about the gold discovery. Even then, many paid little attention. There had been talk of gold before.

Seeing is believing. Sam Brannan had a shop at the fort. He thought how nice it would be to have more customers. So he filled a bottle with gold and sailed down the river to San Francisco. He stepped off the boat, rushed into the Plaza, and waved the bottle above his head. "Gold! Gold! Gold from the American River!" he shouted.

All day Brannan was about the streets, talking to everyone he met. One look at the gold and people began making plans to take off for the gold fields.

Merchants closed their stores. Farmers left their fields half planted. Sailors abandoned their ships. The editor of the paper saw his readers all going, so he went too.

By wagon and boat, on foot, even on crutches, the crowds poured into Sutter's Fort. Some borrowed horses from Captain Sutter to go to the mountains. Others helped themselves without asking. They trampled his fields and butchered his cattle for meat. Workmen at the fort caught the gold fever and left the crops unharvested and the leather rotting in the vats.

So many people were digging gold out of Sutter's kingdom that he tried to win some for himself. He called his Indians together and went on a gold-hunting party.

The trip cost him more than he made. Meanwhile, back at the fort, thieves were taking everything he had. Gold brought ruin to Sutter, while it made others rich.

Many panned out two or three ounces of gold a day and made up to fifty dollars, which was big wages. A few made big strikes. One party went to the hills and cleaned up seventeen thousand dollars in a week. A man, without leaving home, found a two-thousand-dollar nugget under his doorstep. A group of miners, mourning a dead comrade, saw gold gleaming in the dirt beside the grave. So did the preacher. "Gold! Gold! The richest kind of diggings! Congregation dismissed!" he shouted. They staked out claims for themselves, then found a new place to bury their friend.

One day a soldier, riding along a trail, saw something shining on the ground. It was a lump of gold weighing twenty-four pounds. He took it to Governor Mason, who sent it to the War Department at Washington together with a report on the riches of California.

Every river that rolled down from the Sierra seemed to have gold. The Feather and Yuba to the north, the Mokelumne and Stanislaus to the south, were just as rich as the American. Gold-seekers swarmed over the flats along all these rivers. They stripped off the top dirt to get to the "pay dirt" below. They climbed the ravines for rich gravel to dump into their cradles. Tents, shanties, and brush huts were going up everywhere.

Every servant left Monterey, the state capital, for the mines. In Sonoma the judges bought shovels and closed their courts. The San Jose gaoler and his prisoners went digging gold together. Pack trains set out from Los Angeles.

The big gold rush was on.

The news about gold did not confine itself to California. It went round the world. Ships from San Francisco sped the news to Oregon Territory, to Hawaii and China, to Mexico and South America, and, last of all, to the faraway east coast of the United States.

Gold shining in the California streams! Gold a man could win with just a pick and pan! Gold, free to all comers!

The world was in trouble in 1848. There was a potato famine in Ireland, terrible poverty in England, iron military rule in Germany, and unrest almost everywhere. The news about gold was a ray of hope from a New World where life could be better. Thousands of Europeans took ship for America. Many went round Cape Horn, straight to California.

In the United States, times had not been good for ten years. An ambitious young man had little to look forward to—until he heard about California gold.

And what tall tales he heard! A pan of California gravel carried half an ounce of gold on the average.

That was worth eight dollars. You could see the river beds glowing at night, there was so much gold in them. It stuck out of the ground too. One man

offered as much as a thousand dollars if someone would just bring him dinner. He was sitting on a lump of gold too big to carry and didn't want to leave it.

It was hard to believe these astonishing stories. But suppose they were even *partly* true?

Then the twenty-four-pound nugget the soldier found reached Washington and was put in a case where everybody could look at it. It made your jaws drop open.

In December, President Polk sent a message to Congress and said the gold strike looked better all the time. Well, if the President said so, it must be true. That made it official.

All winter long, men read about gold or sat round hot stoves in country shops and talked gold. At meetings in churches and town halls, people formed "companies" to go to California. Each member put up part of the money for tools and travel expenses.

In New York and in Yankee seaports where swift China clippers were a familiar sight, the first idea was to buy a sailing vessel for the run to California. Every old schooner, bark, or whaling ship was fixed up that winter. Often the owners found they could make more by selling tickets to California than by selling the boat.

Cargo space was turned into sleeping quarters for four times as many passengers as a ship was built to hold.

The California-bound voyagers spent five, six or seven months on crowded decks and in narrow, airless bunks. Twice they crossed the Equator, and in between was the passage round the Horn. It might take weeks to beat through icy storms and gain the west coast of South America. It was fifteen thousand miles to California this way.

Suppose the gold was all gone before you got there? You could save thousands of miles by taking a steamer to Panama and crossing by river boat and muleback to the Pacific. The Isthmus was only a narrow neck of land, but it was jungle country, full of yellow fever and malaria. Those who reached the Pacific alive found huge crowds ahead of them, waiting for boats to California.

"But we have tickets," the newcomers would cry.

"So have we," came the reply from the waiting throngs.

Ships from South America were already full of men from Peru and Chile. They had tickets too and were as hungry for gold as men from Georgia and Pennsylvania. There was not even standing room for everybody. Fights broke out as men of many nations scrambled to get aboard. Full forty thousand gold-seekers took the sea routes to California.

Men out in Ohio and Tennessee and on the Missouri frontier knew little about ships but they could handle wagons. So more than fifty thousand went overland to California in covered wagons. They followed trails that only fur traders, soldiers, and a few pioneers had ever used before.

The gold-seekers were mostly young men. To look at pictures of their bearded faces you might not think so, but beards were the custom with young as well as old in those days. Most of the forty-niners were between twenty and thirty. Some took their families, but usually women and children stayed behind.

"I'll make my pile and hurry back," were the parting words to wives and sweethearts.

Some sixty thousand horses, mules, and oxen, and ten thousand covered wagons travelled the California Trail in '49. A company needed four mules or oxen for each wagon, besides spares. The horses were for riding, hunting, and finding camp sites.

From the Missouri River to the American River was over two thousand miles. You could not set out from Independence or St. Joseph much before May 1. If you left before that, the ground was too wet for wagons and the grass too short for grazing. You had to be over the Sierra before the September snows. Reaching California in four months meant making sixteen or seventeen miles a day. You had to average that and still allow time for breakdowns, sickness, difficult river crossings, Indian trouble, and finding strayed animals.

The members of each company elected a captain and sometimes wore military-type uniforms. They were supposed to obey the captain's orders cheerfully. But members of a company were always talking back to the captain. Sometimes they sacked him or split up into separate groups.

Things went well at first, though. The covered wagons rolled over the plains in four files with outriders on horseback. The chuck wagon, a moving kitchen, brought up the rear.

Grass was plentiful in Kansas. Streams ran clear. Hickory groves furnished wood that might come in handy for repairs. Farther west, they said, you could swap a hickory stick for a buffalo robe.

So many companies were going to California that there was an all-day wait at the Kaw River for the ferry. Men, animals, and wagons lined up there for miles. They could ford smaller streams, but as the wheels cut tracks in the mud, the stream banks caved in and the crossing went "rotten." Those who followed had to find new crossings.

The covered waggons rolled over the plains

Near the Platte River in Nebraska the country changed. The air became clear, the trail hard and bumpy. Sand hills stood against the horizon.

"Good-bye, East. This is where the West begins," people said.

There were few trees now except willows and cottonwoods along the streams. It was dry country, but when it did rain the lightning and thunder made the animals stampede.

Sometimes sickness struck just as suddenly. A man got up feeling well and collapsed in the afternoon.

"Cholera," his companions whispered. There was little hope for their friend, and they too might catch the disease. And there was no wood for a coffin. So they wrapped the victim in a blanket and buried him beside the trail. A buffalo skull served as a tombstone.

By day, mosquitoes and gnats plagued the travellers. At night they heard wolves and coyotes.

Some turned back, but most of the wagon trains ploughed on through the sand beside the South Fork of the Platte. They got over bad spots by double-teaming—hitching two teams to one wagon, then coming back for the other. The river was swift and tricky. At the crossing, teams had to keep moving or they bogged down in quicksand.

The run down Ash Hollow to the North Fork of the Platte was so steep and rocky that the travellers took off the wheels and let the wagons down with ropes.

The trail ran along the North Fork through Indian country for almost five hundred miles, passing rocks of fantastic shape. Then the Rocky Mountains came into view.

Fort Laramie, in what is now Wyoming, was a fur-trading post where everyone stopped for rest before crossing the Rockies. There you could buy expensive flour from Sante Fe, New Mexico, and trade your tired-out animals for fresh stock. The rate was three for one. As soon as the animals you left behind were sleek again, someone else would get them. But there was no time to wait. Snow was coming in the Sierra. Besides, the gold might all have been discovered already.

South Pass took the forty-niners through the Rockies to the western slope of the Continental Divide. Rain that fell beyond South Pass flowed to the Pacific. After South Pass there was no turning back. A man who could not reach California could not get home either.

At this point men were so tired that they quarrelled easily. Parties that had gone through hardships together broke up. Two men with a single wagon between them disagreed. So they sawed the wagon in half. One took the front end and one the back.

The nineteenth-century Argonauts sang to keep up their courage. They had new songs now, like the one about the happy miner:

I am a happy miner,
  I love to sing and dance,
I wonder what my love would say
  If she could see my pants.
With canvas patches on the knee,
  And one upon the stern;
I'll wear them while I'm digging here,
  And home when I return.

The real test came between Humboldt Wells and the Carson River. The Nevada air was so dry that wagon wheels had to be soaked in water or the wood shrank and the wheel came apart. Sometimes the sand was hub deep and as fine as flour. The heat seemed to come from a furnace. It blistered men's lips. The lack of fresh foods made their mouths sore with scurvy.

But even if men were sick they had to think first of the mules and oxen. No one would reach California unless the stock had grass and water. The lives of men and animals depended on one another. They were in the same team.

The Humboldt River, in this burning desert, was the lifeline of the forty-niners. It is a curious river, but it gave water to man and beast and nourished a little grass. Unlike most rivers, the Humboldt gets smaller as it flows instead of bigger. It does not reach the sea at all but falls off to a trickle and finally sinks into its parched bed.

Where the water lies in stagnant pools, it is full of alkali and unfit to drink. Men had to fight to keep the thirsty cattle away from this dangerous water. Sometimes the animals drank it anyway, and if they had too much they dropped in their traces and died by the trail. The forty-niners saw dead oxen right across Nevada.

When a party lost its stock, the wagons were use-less. Hence abandoned wagons blocked the trail, too, and were used for campfires. People short of oxen put what provisions they could on the backs of their remaining animals and "packed it" to California. At last so many boxes, trunks, and personal belongings were lying around that the California Trail looked like one long second-hand store.

There was no singing now. It was a life-and-death struggle for the best teams to get through. Even so, you could not let people die in the desert after their last animal was gone. You stopped and took them in.

Ahead was a stretch of a hundred miles without a blade of grass. The trains halted while everyone spent several days gathering wild hay to pull the stock through. They stuffed it into the wagons and tied it in bundles on the backs of the animals.

At last the Humboldt River was nothing but a dry bed with a slough running into it. This was the last water for forty miles. The wagoners filled every barrel and pail, checked wheels and axles, and set out at night for a dash across the desert. By evening next day, if luck was with them, they could see a green line along the Carson River. The animals could smell the fresh water. Nothing could stop them now until they stumbled into the water, belly-deep, and drank.

The desert was behind, but the steepest part of the journey remained—the crossing of the Sierra Nevada. It was a land of canyons and mountains, waterfalls and giant trees. It took double-teaming, with men pushing from behind, to get wagons up the rocky cliffs. In places it was easier to take the wagons apart, pack the pieces on muleback, and put them together again at the top of the crest.

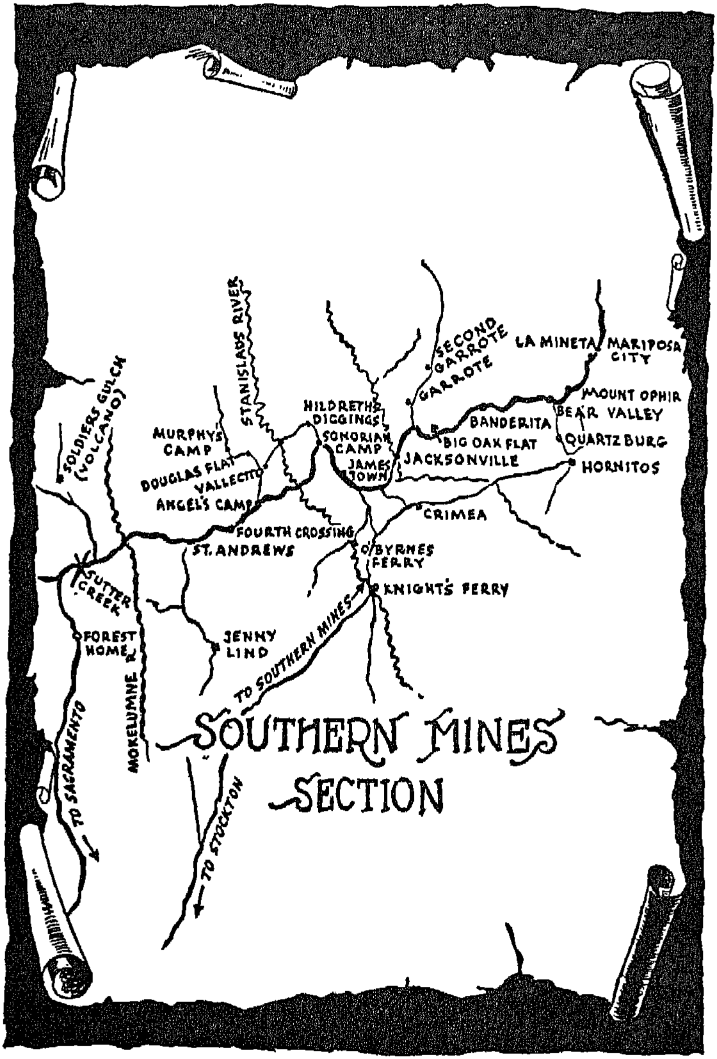
Finally came the six-mile climb to the peak of the Sierra's highest ridge—three miles through forest and three up a barren mountain-side.

A treasure-house lay at the feet of those who reached the summit and saw the broad valleys of the Sacramento and the San Joaquin, reaching out to San Francisco Bay and the blue hills along the coast.

Now to dig gold!

Men who crossed the plains together planned to mine gold together. But when they reached the diggings, it was every man for himself. The best places were crowded. Every new find set off a rush to peg out choice claims. It was first come, first served.

Mining camps soon sprang up everywhere along the 250 miles of Sierra foothill country from Rich Bar in the north to Mariposa in the south. Some were


SOLDIERS GULCH (VOLCANO)
STANISLAUS RIVER
MURPHYS' CAMP
DOUGLAS FLAT
VALLECITO
ANGEL'S CAMP
HILDRETH'S DIGGINGS
SONORIAN CAMP
JAMES TOWN
SECOND GARROTE
GARROTE
LA MINETA
MARIPOSA CITY
MOUNT OPHIR
BEAR VALLEY
BANDERITA
BIG OAK FLAT
QUARTZBURG
JACKSONVILLE
HORNITOS
CRIMEA
FOURTH CROSSING
ST. ANDREWS
O'BYRNES FERRY
KNIGHT'S FERRY
SUTTER CREEK
FOREST HOME
JENNY LIND
TO SOUTHERN MINES
MOKELUMNE
TO SACRAMENTO
TO STOCKTON
SOUTHERN MINES SECTION

"ounce diggings," where a man could pan an ounce of gold a day, then worth about sixteen dollars. Others were good for fifty dollars a day—equal to a month's wages back home.

But everyone dreamed of a rich strike—a "bonanza." Miners at Tin Cup Diggings took out a cup of gold apiece a day. A man at Goodyear's Bar washed two thousand dollars from his first wheelbarrow of dirt. This was flaky gold.

It came in chunks in the southern mines. A twenty-eight-pound nugget popped out of a potato patch in Sonora. Lumps of gold clung to the roots of the grass in Columbia. A boulder sticking out of the trail proved to be worth $8,500.

When a miner was tired of his old claim he went prospecting. He stopped at some likely-looking creek and dug a prospect hole. Then he went down to bed-rock, for if there was gold hereabouts, it would rest on this solid footing. Gold, being heavy, settles towards the bottom of a gravel bar with every flood and every earth tremor.

Next the prospector panned and tried to "raise a colour." It was good news if even a tiny glint of gold showed up as colour in the bottom of the pan. In this case, the prospector worked his way upstream, digging more holes, looking for more colour.

Prospectors knew that you found gold where water flowed. So they followed the mountain streams and went up gulches that were full of water in the rainy season. Early mining camps had names like Rattlesnake Bar, Poverty Flat, and Chile Gulch.

After a month or two, the forty-niners became old hands at the game. They loved to play jokes on greenhorns. A stranger showed up at Smith Bar, looking for gold. The old-timers sent him to the top of a hill and had a good laugh. Up there, with no running water, was the last place to find gold. But the "poor fellow" had the last laugh. He staggered down with a heavy sack of dirt to wash in the creek and from it took $750 in gold! The greenhorn had plenty of company on his next trip up the hill. The others took up claims as close to him as they could get.

Strange to say, there was rich pay dirt up on the hills in many places. A Negro of slave parents found a fortune near Mokelumne Hill. At Carson Hill a mule strayed off and led his owner to a 195-pound gold nugget, the largest ever discovered in California.

In this way prospectors learned that when colour gave out on a stream it was a good idea to follow it up the hillside. Sometimes there was gravel up there that looked just like river gravel. In fact, it *was* river gravel—from the bed of some stream that had stopped running millions of years before when lava choked up its path. Later on, the earth's crust folded and buckled, valleys became mountains, and new gold-bearing rivers were born. But all this time, gold was waiting in the old rivers too.

Wherever gold was, farm labourers, shop assistants, and mechanics were glad to dig it out—yes, and doctors and lawyers, too. They were all equal in the mining camps. It was a long way to "the States," as they called the East. The forty-niners made their own rules at miners' meetings. If the diggings were rich, a man could claim ten feet along the stream. If they were not so good, or had been worked over already, he could have more.

A claim was good as long as the owner worked it. When he went to town for provisions, he left a pick or shovel on the claim. If anyone tried to jump his claim, his neighbours protected it. When arguments arose, the miners called a meeting to hear both sides and reach a fair decision. Sometimes each side chose six men as jurors. Whatever the jury said was right became law.

There were no gaols in the early days and no one locked his door. Miners left thousands of dollars in gold lying around their cabins in tin cans. If a thief appeared, he was whipped out of camp.

Digging in the sun or panning in icy water was the hardest kind of work. But Sunday was no day of rest. Unless there was a preacher in camp to lead services, everyone washed and mended and cut firewood.

The miners wore old slouch hats and red shirts open at the collar. Beards grew long and ragged. It was a man's world. At times, though, it was lonely without women. When the day's work was done, and the fiddler struck up a tune, the miners danced with one another. By turns, half of them tied handkerchiefs round their sleeves and pretended they were ladies—but real ladies would have been more fun.

Later on, smooth-shaven men in silk hats who wanted gold without digging for it started dance halls, saloons, and gambling houses. The lonely miners came to these brightly lighted places to meet friends and hear exciting gold talk from other camps. Young men who never drank or bet before learned to do so and often spent a month's earnings in a single night.

Whisky was a dollar a drink. Like everything else, it was paid for in gold dust. The miner took out his leather pouch, or "poke," and let the bartender reach in and take a pinch of dust between his thumb and forefinger. This was about a dollar's worth—but some pinches were bigger than others.

For this reason, saloon-keepers, when taking on

new help, would ask, "How much can you raise in a pinch?"

A miner who didn't treat the house now and then was called a "piker." This meant he was from Pike County, Missouri, where people were supposed to be stingy. He was also a piker if he did not gamble for high stakes. So "the sky was the limit," and a thousand dollars were won or lost on the turn of a card. It took lots of will-power to remember the girl waiting back East and save one's gold dust.

In time, robbers and bad men showed up too. It was no longer safe to leave gold lying around. Joaquin Murrieta was the most feared. He rode at the head of his gang, wearing a black mask, and plundered camps all up and down the Sierra.

A young miner playing cards in a saloon with strangers boasted that he would kill Murrieta on sight. The man opposite him leaped to the table, pulled out two pistols and cried, "I am Murrieta. Here is your chance!" No one made a move. The bandit left the room in his own good time.

Many a posse went after Murrieta and one at last killed him in an ambush. But this took a long time, for Murrieta could always hide out with his Mexican friends. To them he was a Robin Hood, who took back the gold the gringos had stolen. "Gringo" was the Mexican name for foreigner.

More than once the Mexicans made a big strike only to have the gringos drive them off their claims at gunpoint. The gringos also had fights with the French and Chilean miners. They did not know that America was to be a nation of many nations.

The Chinese had it worst of all. They washed clothes and took jobs as cooks. But they were not allowed to look for gold except in the poorest diggings. The Chinese miners rocked their cradles patiently, pigtails swinging in the air, in places where others had been over the ground two or three times. Somehow they always found a little gold that everyone else had missed.

Americans were in too much of a hurry to use cradles any more. The long tom was faster. It was a flat-bottomed wooden trough, a dozen feet long. A stream of water carried the pay dirt down to an iron grating. Here the finer stuff fell into a riffle box, with cleats, or riffles, to catch the gold. The water carried the worthless gravel away as refuse.

It took six or eight miners to work a long tom, so it was no longer every man for himself. Some dug and poured in the dirt. Others stirred with forks and removed big stones.

A man also needed partners to get a supply of water. It was too much trouble to haul it a bucket at a time, when you could put in wooden troughs upstream and guide the water to a spot right over the tom.

The miners learned all sorts of tricks with water. The long tom was soon not long enough. Water raced through a line of sluice boxes—thirty, fifty, a hundred feet long in all. It swept the gravel along while the gold fell into the riffles and pockets of the troughlike boxes. There it stayed until the clean-up at the end of the week.

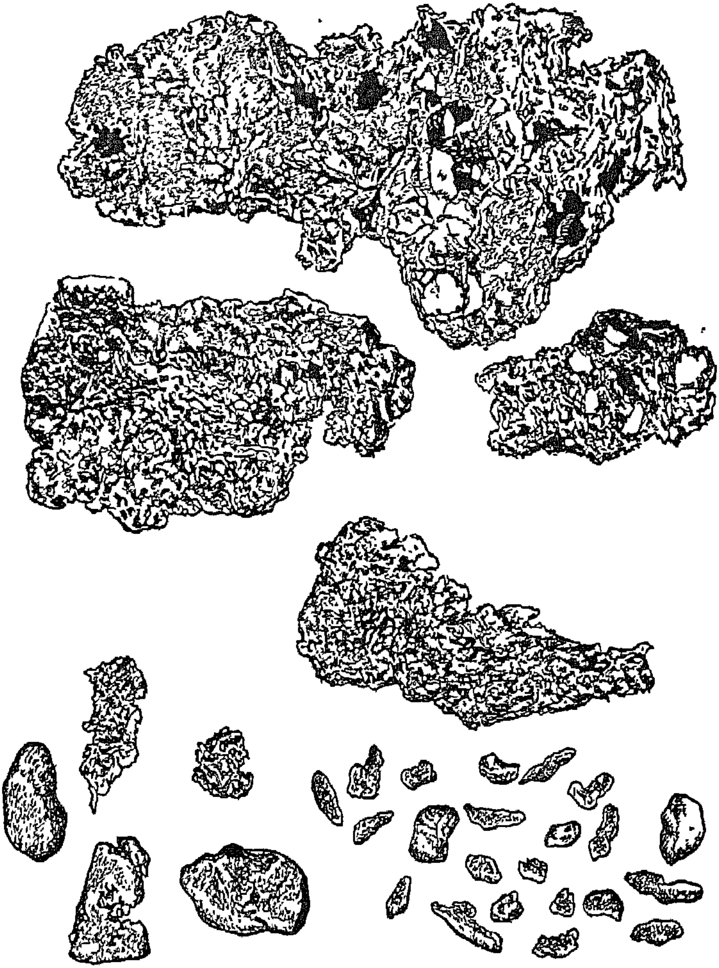
The miners learned to put quicksilver into the riffles to make sure they captured the gold. Quicksilver is a miner's name for mercury, the liquid metal you find inside a thermometer. It has a way of closing in on particles of gold and holding them fast. You free the gold by heating the mixture, or amalgam, in a retort. The mercury passes off as vapour and leaves the gold behind.

A couple of dozen men would team up to buy quicksilver and run a string of sluice boxes. A still larger number had to work together if they wanted to turn a river out of its course and mine the dry bottom. To do this, they built a dam and switched the water round the digging in a canal. If the way was too rocky for a canal, they made the river run in wooden flumes. High up on scaffolding, these flumes, miles long sometimes, carried water round mountains, across ravines, and over the heads of the working miners.

In due time this overhead water was put to work. It dropped through canvas hosing and came out of a nozzle with the force of a fire hose. Miners used it to tear away the top dirt on river banks and get at the pay dirt without tiresome digging. They called this "ground sluicing."

It was just a step to hydraulic mining, in which water is shot from giant hoses with force enough to cut a man in half. Men washed whole bluffs and hills away to reach the pay dirt of ancient river basins.

The miners went deeper and deeper for pay dirt. They tunnelled into hillsides. They sank shafts into gravel and "coyoted" along bedrock, making holes such as coyotes live in. A man at the top of the shaft hoisted the dirt they dug with ropes and windlass.



Two types of gold nuggets: the large, rough pieces are lode gold; the smaller ones come from pacer mines

Where did all the loose gold in the gravel come from, anyway? No one wondered about this much until Mr. McKnight's cow wandered off from Grass Valley one day. McKnight followed the cow and stubbed his toe on a ledge of rock. He stubbed it so hard that a piece of rock chipped off. It was white quartz—and through the white ran veins of gold.

Then, down south at Angel's Camp, a hunter cleaned his gun with a ramrod. The rod stuck in the barrel, and the hunter fired the gun to get it out. The ramrod flew like an arrow into a vein of quartz gold worth $7,700.

This gold-bearing quartz showed up all along the Sierra. The miners called it the Mother Lode. It was the mother of all the gleaming flakes and nuggets. Running water through the ages had freed the gold from the lode and left it in the gravel.

"Placer" mining consists of panning or sluicing this loose gold. Quartz or lode mining is quite a different affair. The hard quartz must be smashed into powder to get at the gold.

The Mexicans carried on lode mining in a mill called an arrastre. A mule walked around and around, hitched to a beam which dragged two big stones over the quartz to break it up. A man poured in water and felt the mixture. He could tell when it was fine enough by putting the thumb and finger of one hand on the lobe of his ear and the other thumb and finger into the arrastre. When the ore was as soft as the ear, he poured in quicksilver to catch the gold.

This was a poor man's way of winning gold. A group of miners who could raise enough money built a stamping mill, run by water power. Iron-shod stamps came down with a thud and pulverized the ore. The powder, mixed with water, passed through quicksilver and over blanket-lined tables which captured the gold.

Digging quartz mines in hard rock, with tunnels and shafts and railway wagons to take out the ore, was far more costly than "coyoting" for placer gold. Owning a mine became a rich man's game. Men without money mined for wages or went into other lines of work.

Only a few of the forty-niners had as much as a thousand dollars to show for their work after a couple of years. Some never made a strike, some wasted their winnings. Even the thrifty found prices high in a country where nearly everyone wanted to dig gold. A workman's shirt cost six dollars, salt pork was eight dollars a pound, and a man paid three dollars for a breakfast of ham, eggs, and coffee.

Shopkeepers like Sam Brannan, who carried the gold news to San Francisco, made more money than the miners. Sutter's Fort became the city of Sacramento. Near Coloma, where Marshall found the gold, is Placerville, where Philip Armour ran a butcher's shop. He went on to be a great meat packer in Chicago. J. M. Studebaker of Placerville made wheel-barrows for miners. Later he made wagons, and still later his company made motor-cars.

"I'll make my pile and hurry back," the gold-seekers had said light-heartedly, on leaving home.

But the forty-niner seldom returned, except to get his family or marry the girl he left behind and bring her to California. The man who made his pile wanted to stay and make another. The man without a pile could at least get a good job and grow up with the Golden West.

In 1849 San Francisco was a row of tents and board shacks with the masts of four hundred abandoned ships in the background. By 1850 it had grown into a city and was the gateway to an empire. On October 18 of that year the *Oregon* steamed into the bay with a streamer flying from the mast.

"California admitted," it read.

California was one of the United States!

The news was thirty-eight days old, but how the bells rang and the cannon boomed as the city turned out to celebrate! People would no longer talk of going *back* to the States. They were *in* the States!

The California excitement touched off gold rushes in other places. Among the forty-niners was Edward Hargraves. English by birth, he went to Australia as a boy and lived there for twenty years.

The big island continent down under the Equator was a lonely place in those days. Young Hargraves was one of the few people who were in Australia by choice. Most others arrived on English prison ships. Some were thieves and cut-throats. Some had done nothing worse than hunt for game on their lord's land.

Free Englishmen went overseas too. But they went to the United States, where land was cheap, not to Australia with its big sheep ranches. The ranchers did not want to see the range cut up into little farms.

So there was not much future in Australia for a man without money. When the gold news came from California, Hargraves was glad to take a ship to San Francisco. He panned for gold at Wood's Creek on the Stanislaus River. As soon as he could, he bought a cradle. Some days the gold weighed out at five dollars, some days at ten or twenty dollars.

Hargraves was not as lucky as others round him, but he was in fine spirits. One day he told a friend: "You know, I have seen country like this in

Australia. The rocks, the looks of the region, are the same. Mark my words, you will hear of a gold discovery there soon. If someone else does not find it first, I shall look for it myself."

Hargraves wandered on to other diggings, but his thoughts were back home. Late in 1850 he returned to Australia. In Sydney he bought a horse and provisions and set out for the country he remembered in New South Wales.

The creeks were nearly dry, but a boy named Lister guided him to a water-hole. Near it, in a dry creek bed, Hargraves saw a bumpy place that would act as a trap for gold—if there was any gold. He removed the gravel, filled a pan with dirt, and washed it in the water hole. In the bottom of the pan was a shining speck of gold.

"Here it is!" shouted Hargraves. He washed five more pans with trembling hands. Four pans showed colour. Hargraves turned to the boy and said, "This is a memorable day in the history of New South Wales. I shall be a baronet. You will be a knight. My horse will be stuffed and put in a glass case in the British Museum."

It *was* a memorable day—February 12, 1851. The discoverers never became noblemen but they won other rewards. The region was rich in gold. Lister, with some companions, cradled two thousand five hundred pounds' worth in a week. The Australian provinces of New South Wales and Victoria gave Hargraves fifteen thousand pounds for his discovery.

He was happy to let others dig the gold. "My only desire," he said, "was to make the discovery."

An official told him, "This will stop the Home Government from sending any more convicts. Englishmen will come to Australia instead of rushing to California."

Not only Englishmen, but Irishmen, Frenchmen, Germans, and Italians hurried to Australia. Even Californians dropped their shovels and were off to join the new gold rush.

Gold-seekers poured into Sydney by tens of thousands. Even larger numbers came to the port of Melbourne when gold was discovered at Ballarat, farther south.

California and Australia, between them, produced almost as much gold in ten years as the whole world had ever dug before. The biggest nugget of all time came to light at Ballarat in 1869. It lay in a wagon rut a few inches below the road surface—2,520 ounces of almost pure gold. The finder named the nugget "Welcome Stranger."

Later, the Kalgoorlie fields of Western Australia proved rich in gold. In this dry country the miners panned with wind instead of water. They let the dirt drop slowly from one pan to another until the lighter particles blew away and the gold remained.

At first, the gold was not free to all comers, as it had been in California. The sheep ranchers tried to keep the prospectors off the range and halt the gold rush. Arrogant officials, used to dealing with criminals, demanded big fees, at pistol point, for mining licences.

But men who left Europe in search of freedom, and men who had learned self-government in California, could not be handled like convicts. After three years of trouble, a miners' meeting declared Australia a free republic like the United States. Twelve hundred miners from the Ballarat gold fields took their stand in a stockade at Eureka Hill, and thirty died defending it. The leaders were arrested, but soon they were all freed because public sympathy was with the miners. Eureka Hill was a landmark in Australia's march to freedom.

A new constitution, four years later, gave every man the right to vote. Australia grew into an advanced democracy in the British Commonwealth. The gold rush changed the big island from a convict camp into a nation of free men.

"Oh, for another gold rush!"

That is what Americans were saying in 1857. It was eight years since the big rush of '49. For a while, shiny new coins of California gold jingled in everyone's pocket. Business was lively—until 1857. Then, suddenly, the magic wore off. Hard times came back. No more gold lay around in California, loose and free. If only it would show up in some other place! The country was itching for more gold.

Green Russell of Georgia was better off than some. He came back from California with enough gold to live on comfortably. Russell was tall and handsome. He waxed his moustache and braided his beard in two neat little plaits that came down to his chest. The neighbours looked up to Green Russell.

He was an "old digger." Gold-digging was in his blood. He remembered the early days when he had washed gold in Georgia's Indian country and married his Cherokee wife. He lived over in his mind the days on the road to California. Even now, after eight years, he remembered the specks of gold he had seen in the pan when he tested the gravel along various Rocky Mountain creeks. It was not enough colour to stop a man on his way to California in 1849. But it got Russell excited in 1857, all because of something his wife told him.

Mrs. Russell received a message from her Cherokee relatives out West in the Indian Territory. They had been to the Rocky Mountain country on a hunting trip. When Cherokees went hunting, they liked to pan the gravel here and there—like old times in Georgia. It was a good thing they did on this particular trip—because they found gold! There was plenty of gold in the western mountains, the message said.

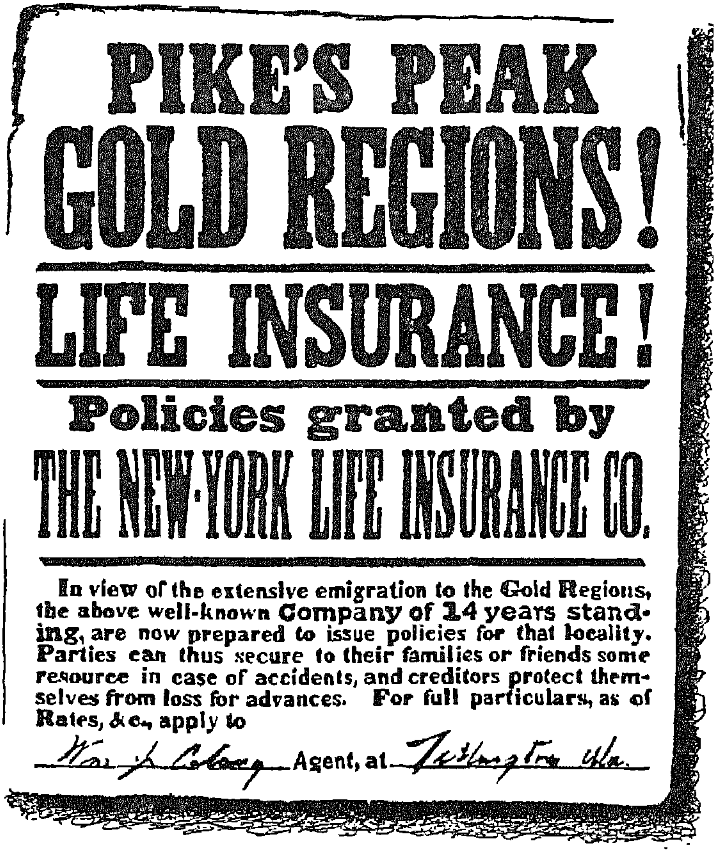
The news made the gold fever burn inside Green Russell again. The old digger organized a party and set off for the Rocky Mountains early in 1858.

Others heard similar stories. A butcher in Lawrence, Kansas, talked to a Delaware Indian who was an army guide. The Indian said he had seen golden nuggets in streams that were "two sleeps from Pike's Peak." The butcher closed shop, and he and his friends set out to find the spot.

Pike's Peak rises so sharply from the plains of Colorado that travellers see it long before they reach the mountains. The peak, ablaze in the setting sun, became the landmark of a new gold rush.

Russell's Georgia party started panning for gold on the creeks that run into the South Fork of the Platte River. A trader from Fort Laramie stopped by to have a look and take a sample of the dirt. Then he drove on to Kansas City and told a crowd that the Pike's Peak country was full of gold.

People had heard big gold talk before, but the trader had his proof with him. He took a sack of dirt from the wagon and panned it before the un-



PIKE'S PEAK
GOLD REGIONS!

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Policies granted by
THE NEW-YORK LIFE INSURANCE CO.

In view of the extensive emigration to the Gold Regions, the above well-known Company of 14 years standing, are now prepared to issue policies for that locality. Parties can thus secure to their families or friends some resource in case of accidents, and creditors protect themselves from loss for advances. For full particulars, as of Rates, &c., apply to

Wm. J. Colony Agent, at Wellington Ala.

believing crowd. Each panful left a lovely wriggle of gold behind, and all doubts vanished.

The gold was a sight for sore eyes. Business was bad in these frontier towns. Nobody was going West. Well, here was something to start them going!

A newspaper trumpeted the story of a Pike's Peak gold strike. Other papers copied it. The story grew bigger with each telling.

D. C. Oakes of Iowa wrote a Pike's Peak Guide. Gold was everywhere, he said—on the plains, in the mountains, and by the streams. People all over the United States gobbled up the good news. It was what they wanted to hear.

Green Russell became a hero overnight. Everyone told stories about him. When Russell wanted some gold, he backed up a cart to the side of a hill and shovelled it in. When he was tired shovelling, he slid down Pike's Peak on a sled. The sled had iron spikes on the bottom which tore loose the gold. On an ordinary slide, a million dollars' worth of nuggets came tumbling after. Or so people said.

Pike's Peak! That was the place to head for!

A real-estate promoter thought it was a good place to start a city. He led a party towards the Rocky Mountains without waiting for spring. On the trail he met a horesman bound for Georgia. The stranger said he was from the diggings and hoped to return in the spring with reinforcements for his party. Only a dozen of the old group were staying on, he explained. The rest were discouraged. They had only a few hundred dollars' worth of dust for a summer's hard digging.

"But Green Russell is taking out millions in gold," said the promoter.

"I am Green Russell," said the stranger.

The other man could hardly believe his ears. Why, Green Russell was supposed to be as rich as Croesus!

"I have faith in the country," Russell explained. "But so far there is only a little gold. Go see for yourself."

The party went on to Pike's Peak and turned north to the gold fields along Cherry Creek. Others were there to build a city too. Later it was to be the city of Denver. But that winter the settlers barely got into log cabins before the snow fell.

The big rush came in the spring. Six hungry, half-frozen men stumbled into camp in January, pushing their belongings in hand carts. They were the first to arrive and told of thousands behind in the frontier towns, waiting to dash across the plains.

Every Missouri River steamer brought more. The flying banners read, "Ho! for the Gold Fields of Kansas." (The Pike's Peak country was then part of Kansas.)

The fifty-niners, one hundred thousand strong, came in covered wagons decorated with a brave slogan, "Pike's Peak or Bust!" Those without wagons pushed wheelbarrows or carried packs.

What did it matter if they reached Pike's Peak without food or money? The gold they dug would pay for everything.

It was a cruel disappointment to the gold-mad crowd to learn that a man might prospect for weeks before he raised even a little colour. Meanwhile, beans and bacon would cost him a fortune.

As the gold-seekers poured in, prices went sky high. Those without money faced starvation. "It's a humbug!" they told one another. In May a stampede back across the plains began. The "go-backs," as they were called, warned others they met to go no farther.

In place of "Pike's Peak or Bust!" the returning wagons carried just one word: "Busted!"

The go-backs raged at D. C. Oakes and his guidebook. They set up make-believe tombstones along the road with words like these:

Here lies the body of D. C. Oakes,
Killed for aiding the Pike's Peak hoax.

Was it all just a hoax? Not for George Jackson, John Gregory, and Green Russell. They found plenty of gold in 1859. Perhaps they were lucky. Perhaps they knew how to look for gold.

Jackson was a cousin of Kit Carson, the famous scout. He prospected the Clear Creek country, west of Denver, in three feet of snow, while others were snug in their cabins. A mountain lion stole his food and a wolverine nearly killed his dogs. The gravel bars were hard and frozen.

Jackson picked a likely spot and built a roaring bonfire to thaw the ground. He panned eight cups of dirt, raised a little colour, and found a nice nugget in the ninth cup. This was enough for the time being. Jackson blazed a fir tree with his hatchet so that he could find the spot in the spring. Back in camp he kept his mouth shut "as tight as a No. 4 beaver trap." Jackson Bar, his find, became the rich mining camp of Idaho Springs.

Gregory was an old Georgia digger like Russell. He knew where to look for gold but needed a grubstake—money to keep him going while he mined. Gregory was ragged and hungry when he met a party from Indiana, so he told them, "You put up food and transport; I'll put up my mining experience. We'll find gold."

The party agreed to this, and Gregory guided them to the North Fork of Clear Creek. They took out a thousand dollars in five days and named the place Gregory Gulch. Millions in gold came out of the gulch in less than two years. The camp was so crowded that miners slept in two-tiered bunks, one above another. George Pullman made a fortune in Gregory Gulch. Later he made another fortune building railway sleeping cars with upper and lower berths, like the miners' bunks.

As for Russell, he was soon back with a couple of hundred old-time Georgia diggers. They settled at Russell Gulch, and this too became a rich and famous gold camp. Russell organized a big company to bring water to the sluice boxes and took part in many other mining ventures. He spent his old age in the Indian Territory among his wife's Cherokee people.

The good luck of these three men started a new gold rush. Some of the go-backs heard the news before they reached home, and turned round and went back. Others were sure it was still a hoax. They were through.

Horace Greeley, editor of the New York *Tribune*, came to the diggings in the summer of 1859 to learn the truth. He talked to the miners, and when he came to Gregory Gulch, he wanted to pan some gold with his own hands. This worried the miners. They knew the gulch was rich in gold. They knew that Greeley, with his stylish chin whiskers, was a very smart man. Still, he was a tenderfoot when it came to panning gold. There was no use taking a chance that he would miss the gold.

One of the miners fired gold dust into an old mine with a shotgun. He "salted" the walls until they shone.

The diggers guided Greeley to the salted hole, where he dug several shovelfuls of dirt. He washed the dirt with his own hands and saw the gleaming pan bottom with his own eyes. He tried a second pan. It was just as rich. So was a third.

"Gentleman," said Greeley solemnly, "I have no hesitation in saying that this discovery is the richest and greatest in America."

Greeley's own story of his trip to the mines was printed all over the country and made the gold rush bigger than ever. Rich strikes followed at California Gulch, Buckskin Joe, and many other places. The new land of gold became the state of Colorado. The long stretch between the Missouri River and California was no longer just empty space.

Horace Greeley had great faith in this new country. He often wrote about the West, and more than once he gave a piece of good advice to boys who were starting out in life.

"Go West, young man," he would say. "Go West and grow up with the country."

The forty-niners took four months to reach California by covered wagon. A dozen years later, young

Sam Clemens rode almost as far by stagecoach in twenty days. His brother was going to be Secretary of Nevada Territory. Sam went along to see the new mining excitement.

A big rush was on to Nevada. A vast treasure-house lay near the spot where thirsty oxen had plunged into the Carson River in 1849. No one had bothered to look for gold in Nevada then. Later on, prospectors found nice colours there, but mixed up with the gold was sticky "black stuff" that was hard to get rid of. It was a long time before they found that the black stuff was silver.

The miners were panning gold on top of the world's biggest silver mine! There was forty times as much silver as gold. But gold is so precious that it was really a gold mine too. The rich diggings took the name of the Comstock Lode.

The lode was like a magnet. It pulled in California miners who still dreamed of a big strike. And it pulled in adventurous youngsters like Sam Clemens, who had missed the '49 rush.

Sam rolled West behind six fast horses. The big Concord coach moved day and night, stopping only for meals and fresh teams. Sam liked to ride on top with the driver. At night he stretched out on mail-bags inside the coach.

Even this coach was not fast enough for the most important mail. For five dollars you could send a letter by Pony Express and it would reach California in ten days.

The record from St. Joseph, Missouri, to Sacramento, California, was seven days and seventeen hours. The Pony Express made this time carrying President Lincoln's First Inaugural Address. Now that the Civil War was on, speedy communication was vital if the Union was to hold together.

One of Sam's fellow-passengers was building a telegraph line across the desert. After many difficulties, this wartime telegraph line, linking coast to coast, was joined at Salt Lake City in October 1861. Brigham Young, the Mormon leader, sent the first message. It read, "Utah is firm for the Constitution and the laws of our once happy country."

In the next three years, Sam saw Nevada Territory grow into a state. Virginia City was as lively as any old-time California mining camp. It stood on a mountain side, one street above another. A man's front porch looked over his neighbour's roof. Freight teams and mineral wagons crowded the main street. Blasting went on all night in the tunnels of the Comstock Lode under the city.

Nevada's silver and gold helped to pay the expenses of the Union army.

Soon treasure poured into the war chest from the

North-west, too. An Indian trader discovered gold in the Clearwater River country, and a rush was on to what is now Idaho. It spread to the Salmon River and the Boise River.

A prospector from Colorado made a big find in Grasshopper Gulch at Bannack in the present Montana.

This set off another rush. Gold-seekers came up the Missouri River by steamboat. Some were from the North, some from the South.

Back East, their brothers were shooting one another. Here in the West, they argued a lot but most of the time they thought about the future. Americans from many states—even states at war—became a single people in this new country.

It was a rich country. Bummer Dan of Virginia City, Montana, was punished for stealing by being made to work a claim high up the gulch. Dan, lazy as he was, dug up a fortune.

Four prospectors panned here and there with no luck, then came to their "last chance" and struck it rich. Last Chance Gulch is now the main street of Helena, capital of Montana.

Sometimes Confederate prisoners were turned free if they promised to go West. A group of these settled at Confederate Gulch, Montana. Pans ran as high as a thousand dollars each. Mule wagons carried two tons of Confederate Gulch gold to a Missouri River steamer bound for St. Louis.

Young Sam Clemens went from Nevada to the California mining camps and saw a friend pan seven hundred dollars' worth of gold in a week. Half of it could have been Sam's—but he had decided he was not cut out to be a miner. All he wanted to do was watch and listen to the miners talk. He heard a tall tale at Angel's Camp about a frog that lost a jumping contest because the owner of the other frog stuffed him full of shot.

Sam wrote up the yarn and signed himself Mark Twain. The story made him famous.

By this time Mark Twain could cross the country in four and a half days. The gold of the West paid for a railway across the nation. Work began during the Civil War and went ahead in real earnest after peace returned.

It was a race between two railways. The Union Pacific built west from Nebraska, the Central Pacific east from California. The Government paid out money and land for each mile of track to hurry the job through.

Four forty-niners promoted the line from the West. They had come to California to dig gold but found it easier to sell dry goods, groceries, and miners' tools. So they became merchants in Sacramento. Now they were railway builders, the Big Four of the Central Pacific—Charles Crocker, Mark Hopkins, Collis P. Huntington, and Leland Stanford.

Could a train really go over the steep grades of the Sierra? Many said no. Imagine cutting a right-of-way into the sides of mountains and blasting tunnels through granite! Miles of track had to be covered with sheds or lie buried in ten feet of snow. Rails had to come round the Horn by ship.

Still, it was either full-steam ahead or let the Union Pacific get there first. Irish labourers were pushing this rival line across the plains. Up ahead, one crew of workers dumped the rails. Another, right behind, hammered the spikes and riveted the track. These Irish railway builders put down four rails an hour, just like clockwork.

Labour was scarce in California. Irishmen could get better jobs. The Chinese did the hard, disagreeable work. So the Central Pacific hired Chinese labourers, thousands of them. They blasted through the Sierra granite and toiled in the Nevada sun among the white bones of oxen that had died of thirst in '49.

The Irish from the East, the Chinese from the West, built the railway that made the United States truly united from that time on. The lines met at

Promontory Point, Utah. On May 10, 1869, it was time to drive the last spike.

It was a Golden Spike, for without gold the railway would have been a long time a-coming. A locomotive inched up on each line until the cow-catchers touched. Government and railway officials, workmen, Indians, Mormons, and frontiersmen in buckskin were on hand for the big event.

Leland Stanford was now Governor of California. He drove the spike home with a silver hammer. A telegraph wire carried the news to every town in America. Waiting crowds cheered and paraded to the sound of cannon.

Nineteen words were engraved on the Golden Spike—and in every American heart:

"May God continue the unity of our country as this railroad unites the two great oceans of the world."

A United States Army secret mission started the strangest gold rush of all. In the summer of 1874, General George A. Custer of the Seventh Cavalry rode into the Black Hills of South Dakota at the head of a thousand soldiers and a hundred supply wagons.

It was a dangerous place to be. The Sioux Indians believed the hills to be the home of the

Great Spirit, who granted them success in the buffalo hunt.

Bold, hard-riding Custer knew that white men took their lives in their hands when they went into the Black Hills. A few who did, told of finding gold along the clear streams of the pine canyons.

Of course, General Custer could not hide a thousand men. His secret was that two of them were not soldiers at all but California miners. They were along to pan the gravel for gold.

If there was no gold worth digging, then the government could say so. It could tell prospectors not to risk their lives and not to bother the Great Spirit.

But if there *was* gold, lots of it, then trouble was sure to come—if the news leaked out.

Custer, a boy hero in the Civil War, was now thirty-five, with light, curly hair. The Indians called him Yellow Hair. They were not happy to see him. The less they saw of white men the better. The Indians had stayed away from the railway. Let the paleface stay away from the Sioux hunting ground. His smell scared away the buffalo.

So murmured the Sioux. But it was a gay holiday for Custer's men. The miners—Horatio Ross and William McKay—had never had it so easy. The wagons carried grub and tools. They dug prospect holes and panned along French Creek. Near the present town of Custer, South Dakota, they struck it rich.

The pan bottoms flashed with spangles of gold. General Custer ran his fingers through sand as yellow as his flowing hair. He sent a report to the War Department, saying, "I have before me forty to fifty particles of pure gold."

This was real gold country—no doubt about it any longer.

The mission was accomplished. The procession filed out of the Black Hills. Grim-faced Sioux, watching unseen, held back their fire. They hoped Yellow Hair was gone for good.

"Remember, not a word about this," General Custer cautioned his men.

But when a thousand men know the hiding place of gold, you can be sure that a million men will soon hear of it. Within a month a Chicago newspaper had come out with big, black headlines: GOLD . . . IN THE BLACK HILLS . . . RIGHT UNDER THE HORSES' FEET!

At once a gold rush was on. Prospectors pushed into the Sioux country. Some found gold. Some lost their scalps. A big party moved into French Creek and built a stockade. Armed men stood guard while others dug.

The Indians went to the Government agents. "Tell the Great White Father," they said, "that we have kept our promises. Ask him to make his children keep theirs. This country is ours by treaty."

The Great White Father was President Grant. His soldiers made the party at French Creek leave the Sioux lands. But more parties were on the way.

So the Government agents sat down in council with the Sioux chiefs. They said the gold-seekers were like the waves of the sea. Nothing could stop them. But the Great White Father would gladly buy the Black Hills from the Sioux so that his children could take out the gold in peace.

The debate went on for hours. The Indians argued that when the white man came the buffalo left. And the Sioux could not live without the buffalo.

Food, shelter, clothing, tools—the buffalo furnished all these things, the chiefs explained. His dressed skin covered the lodges where the Sioux slept in warm robes during the winter. His hide made moccasins, shields that would stop arrows, and boats for crossing rivers. The bones were good for hoes and scraping tools.

Besides, how long would the white man be satisfied just to mine gold in the Black Hills? Soon he would drive in cattle and the herds would spread over the whole range. Railways would follow. Hunters like Buffalo Bill would shoot the buffalo for meat. Others would kill those that were left for pure sport.

No, the Indians did not want to sell the home of the Great Spirit. The council broke up with angry words.

Impatient crowds of gold-seekers were waiting just outside the Sioux country, and the army no longer tried to hold them back. The gold-hungry mob surged into the diggings. Usually they were safe so long as they stuck to their camps. But when a prospector went out alone, his friends might find him sprawled out by some lonely creek, his scalp missing, his gold poke untouched by his side.

Late in 1875, James Pearson, a daring gold-hunter, slipped into a gulch in the northern hills. Dead trees on the steep slopes were a sign of some recent fire. The gold-bearing sands at the foot of the gulch were even richer than those of French Creek. Pearson called the place Deadwood Gulch. Winter was closing in. But at the first sign of spring the Deadwood rush began—and with it the never-to-be-forgotten "Days of '76."

Deadwood was the wildest, toughest mining camp of all. The Great Spirit must have left when twenty-five thousand palefaces moved in—miners, saloon-keepers, gamblers, gunmen, adventurers of all sorts. They were rooting, tooting, noisy Wild West characters.

It was a summer of bad Indian scares. The Sioux war leader, Crazy Horse, met the army regulars in pitched battle with guns and tactics as good as theirs. On June 16 Crazy Horse defeated General Crook in the Battle of the Rosebud, near the Yellowstone River. Such a thing was unheard of! But worse things were to come. Nine days later Custer made his Last Stand on the Little Big Horn. It was the greatest disaster in all the history of Indian fighting!

Now Deadwood realized what it meant to have a gold rush in hostile Indian country. Bands of Sioux closed in. They picked off prospectors by ones and twos. They stole horses and stampeded cattle.

Crazy Horse fought on against white men until the spring of 1877. But he could not hold back the sea. There were too many palefaces. Soon all the Sioux went to live on reservations.

Fortunes came out of the great placer diggings of Deadwood Gulch. There was a big new strike over the hill at Lead. This was the beginning of the Homestake Mine, now the biggest gold mine in the United States.

Jack London, nineteen and big for his age, sat in the freshman class at Oakland High in California. His legs would not go under the desk. His hair tumbled over his blue eyes. He felt shy among boys and girls of fourteen. They wore neat clothes and came from nice homes. He lived in a shack on the waterfront.

Jack had missed several years of school because his mother was sick and his stepfather was out of work. During this period he ran a fishing boat in San Francisco Bay and sailed on a schooner to Japan. He had made up his mind to be a writer, so now he was back in the classroom to get an education.

Jack worked as the school janitor, wrote pieces for the school paper, and crammed for the college entrance examinations. Soon he was in the University of California. But he did not stay there long. His parents needed money, so Jack went to work in a laundry. Twelve hours a day he lifted steaming tubs, while the stories he wanted to write raced through his mind. He typed them out on his day off and sent them to magazine editors in New York. The stories all came back.

Jack kept on trying. He knew he was just a beginner and needed practice. But there was so little time. How could he work twelve hours a day and write too? He hated the laundry.

About this time the Yukon gold excitement hit Oakland and the San Francisco region. It was almost fifty years since the days of '49, but the gold fever was still catching—especially in California.

Jack read the newspapers eagerly. The stories told of rich strikes in Canada's north country near the Alaskan border. A California prospector and two Indians had turned their boat up the Klondike River from the Yukon. They had poled upstream for two days and poked into little side creeks. On one of these they had found gravel worth $250 to $800 a pan!

Down at bedrock, slices of gold showed up between layers of gravel—"like cheese sandwiches," the stories said. The three men—George Washington Carmack, Shookum Jim, and Tagish Charlie—took out two-thirds of a million dollars with three frying pans! They gave the place the name of Bonanza Creek.

Old-timers rushed there from Alaska and the Canadian North-west. They took up all the claims on Bonanza Creek and spread out to Hunker Creek and Eldorado Creek. Many sold their claims for fifty thousand or a hundred thousand dollars. Some stayed on and took out half a million.

This happened in the summer of 1896. When Jack heard the news he wanted to be off to the Yukon at once. So did a million other young Americans. They put on buttons reading, "I'm going in the spring"—and a quarter of a million actually started out in '97 and '98.

How much better than working in a laundry, thought Jack. The only trouble was that it cost money to reach the Klondike. There was the boat ticket to Alaska to pay for, besides tools and blankets and enough food to last a year. If you did not have a thousand pounds of food and five hundred dollars in cash, the Canadian Mounted Police would turn you back.

Jack went to his sister. Her husband was older than Jack but had the gold fever too.

"It's the chance of a lifetime," said Jack's brother-in-law. "I'll mortgage the house, do anything, to join the rush. Jack and I can make the trip together."

The two men sailed in March of 1897. A month later they were on the beach at Dyea, Alaska, with two tons of baggage beside them. The Yukon lay over the mountains, beyond snow-covered Chilkoot Pass. The pass was thirty-five miles long. A thousand steps, cut into the frozen ground, led over the top.

Each man had to get a ton of food and tools over this steep pass. People with enough money could hire Indian packers, but not Jack and his brother-in-law.

Jack was not discouraged. "We'll pack the stuff across ourselves," he said.

"You are young and strong," replied the other man. "But one look at that pass is enough for me. This is no game for an older fellow."

Jack offered to pack for both of them, but his brother-in-law knew by now that the pass would be only the first of many hardships.

"This is a young man's gold rush. You go ahead, Jack, and good luck." Sadly the older man took the next ship back to San Francisco.

Jack teamed up with three other men, and they set to work packing. Each man picked up as much as he could and carried it over the first lap of the journey. Then he left it and went back for more. The pile of belongings moved forward a few miles at a time.

Each lap took several days. The thousand steps over the top of the pass were the hardest of all. Jack shouldered 150 pounds at a time—as much as an Indian. He passed gold-seekers who had stepped aside to rest. They lay in the snow, puffing for breath.

Jack kept going for six miles—up the slope, over the steps, and down the other side. When he picked up the canvas-lashed bundle in the morning, he felt cold. Before long he warmed up and peeled off his coat. By noon he was down to a red flannel undershirt. Astonished Indians watched him pass and beat them to the top.

Day after day Jack took 150 pounds over Chilkoot Pass. After several weeks he and his friends had eight thousand pounds across the mountains.

They were at the head of a lake. It was still more than five hundred miles to the Klondike. The next job was to build two boats. Here the tools they lugged across the pass came in handy. The men cut trees and whipsawed the logs into planks. They caulked the joints and stitched canvas for sails. After weeks of work they stowed their goods aboard and took off.

A string of lakes led to the headwaters of the Yukon River. Along the course were treacherous rapids. White Horse Rapids were the worst of these. Hundreds of travellers waited here afraid to go on.

"It's worth your life to shoot the rapids," they warned Jack's party. "Every boat that's tried has been dashed to pieces."

Jack's training as a sailor helped him out. He knew how to work with the current and not fight it. People held their breath as he took the first boat over. When he got through safely they broke into cheers. After he had the second boat over, everyone wanted him for a pilot. Jack stayed at the falls quite a while. He took boats through at twenty-five dollars each and earned three thousand dollars for his party. Then they had to hurry on.

It was already autumn. The nights grew longer. Snow fell on the forest floor and hung from the spruce branches. The Yukon froze, first along the edge, then out towards the middle, until only a narrow channel was left. Then even the channel froze over. Jack and his friends were seventy miles short of Dawson, where the Klondike flows in to the Yukon.

There was nothing to do but dig in for the winter. They found an abandoned cabin and set up housekeeping. A Klondike stove kept them warm and snug. On it they fried bacon, baked bread, and made a rabbit stew when the hunting was good. Following the tracks of game in the snow and piling the sled high with firewood kept them fit.

The best thing about the cabin was the company it attracted. Everyone who travelled by dog-team came that way. You could always find shelter in a Yukon cabin. Even if the owner was away it was all right to come in so long as you left as much wood as you found. But it was a serious crime to burn a man's wood and leave without cutting more.

A good part of the Klondike gold rush passed Jack's front door that winter. Everybody dropped in for a chat. At Jack's warm and hearty greeting, people stayed for a meal or for the night. They sat round the red-hot stove and spun tales. Jack never missed a word and he asked all the questions he could think of.

Many of the visitors were cheechakos, or tenderfeet. But sourdoughs came by too. A man who saw the Yukon ice come in and go out again was a sourdough. He knew his way around after a winter in the frozen North. When he baked his bread he saved a little dough from one batch to the next. He used this sour dough to make the bread rise. He could "mush"—drive a dog-team—and steer clear of thin ice or of boulders half hidden under the snow. His feet were apt to sweat, so he had to know how to light a match, even in a snowstorm, and build a fire to dry his socks.

In this cold climate you never travelled with wet feet, no matter how much trouble it was to stop. The sweat would freeze and so would your feet. And a man without feet was not much good for the trail.

After twelve hours of mushing, the sourdough was ready for supper and bed. He pitched camp and fed the dogs first and himself afterwards. Then he laid some spruce bough on the snow under his tent and wrapped himself up in his blankets. It might be forty degrees below zero, but he slept as warmly as his huskies, who curled up in the snow with their tails over their noses.

An assayer examines a sample of ore brought in by a gold prospector. His test will determine if a profitable seam has been struck.

French-Canadian dog-drivers on the mail run from Dawson stopped in at the cabin to say hello. So did white "squaw men" with their Indian wives. Jack was surprised to see how an Indian girl could do a man's work on the trail. She guided the sled at the gee-pole all day or ran ahead of the dogs and packed down the newly fallen snow. A squaw man had a faithful helper in his wife.

Jack talked to Canadian Mounties in scarlet coats, Siwash Indians, bearded old trappers, and miners who were taking out their gold in moosehide bags.

Everything he saw and heard he wrote down in a notebook. He described how men dug gold in the Klondike when the ground was frozen solid. They built a wood fire and thawed the earth for a foot or two. They threw out the loose muck and gravel. Then they built another fire in the hole. At fifteen or twenty feet they reached bedrock and shovelled out the pay dirt. At least they hoped it was pay dirt. They would not know until Spring. There was no water now to wash the dirt. The creeks were solid ice.

The sun was up only two hours a day—and not much up then. The miners dug away in darkness and cold. There was just one good thing you could say about the weather. It froze the ground so hard that you were safe in the mine tunnels. The ceiling never caved in.

When the ice went out in the spring, Jack and his friends lashed some logs into rafts and floated down the Yukon to Dawson. They sold the logs for a good price, for Dawson was a boom town. Cabins and wooden stores were rising everywhere. Forty thousand people were moving in.

Up the Klondike the spring clean-up was on. The creeks were running, and the miners washed out the winter's diggings in cradles and sluice boxes. The lucky ones brought their dust to Dawson and used it for money or left it in the stores for safe keeping. Jack saw millions of dollars—tons of gold—piled up behind the counters in long, narrow bags.

The rush was on to every creek for a hundred miles around. But the best claims were gone and few struck it rich who were not on the ground early. There was not enough gold to make forty thousand people rich, even in the Yukon. There was not enough fresh fruit and vegetables to keep them healthy. Jack, strong as he was, came down with scurvy. His gums were sore, his teeth went loose, his face broke out in sores. Like many others, he had to get back to the States.

Jack was not going, though, before he saw Alaska. In June he started down the Yukon in a small boat with two other men. They sailed through the heart of Alaska for nearly two thousand miles. The sun was still up at midnight and real night hardly came at all. Jack saw Indian villages, herds of caribou, and endless forests. He saw mosquitoes, too—fierce ones in big, black clouds. He slapped away, but they settled by the hundreds and covered him with welts.

Finally the travellers reached Eskimo country and the Bering Sea. They were not far from Nome. But it never occurred to them to go there. How could they know that in less than a year a big gold rush would turn this sleepy village into another roaring camp, where miners would take fortunes out of the sand on the beach?

Jack stoked the furnace on a ship and worked his way home. He came back with no gold, but his mind was full of the wonder of the Northland. He remembered a blizzard that raged on a trail one night and how comfortable and warm the cabin felt. He wrote a story in which the hero looked out on such a storm and offered a toast.

"Here's to the man on trail this night," it went. "May his grub hold out, may his dogs keep their legs, may his matches never miss fire."

Jack sold "To the Man on Trail" for five dollars. It was not much but it was a start. He wrote more stories—tales about gold-seekers, Indians, dog-mushers. Finally he wrote the story of Buck, a big, friendly California dog, who became a sled dog in the North. Hardships taught Buck "the law of the tooth and fang." He fought the fierce huskies and made himself the leader of the team. Buck took pride in his work and served his master well. But he made friends among the wolves too. The wolf howl was the voice of his forgotten dog ancestors. One day his master was killed by Indians while hunting for a lost gold mine. In this way the dog lost his last ties to man. And then he heeded the call of the wild and joined the wolf pack.

Jack sold "The Call of the Wild" to the *Saturday Evening Post* for two thousand dollars. This story made him famous. After that he wrote dozens of stories about the Yukon and Alaska. Millions of people all over the world read these stories—and still do.

The exciting days of the Klondike live on in Jack London's pages because he joined the rush, kept his eyes and ears open, and panned out the gold of a thousand memories.

5: GOLD IS WHERE YOU FIND IT

GOLD is very heavy—more than nineteen times as heavy as water. At the same time it is soft and easily worked. It can be pounded into sheets unbelievably thin. A million of these sheets, one on top of another with no daylight showing, would be about three inches high. You can draw out a tiny lump of gold into a wire many miles long—if you know how.

Gold will stand lots of wear and tear. It does not tarnish in air or water. Most acids do not hurt gold, but it will dissolve in a mixture of hydrochloric and nitric acids.

Gold melts at a temperature of 1,945 degrees

Spools of gold are cut into square sheets before they are beaten

Fahrenheit and turns into vapour at about 4,800 degrees. This vapour condenses into finely divided gold that is no longer yellow but ruby or purple.

Gold also changes colour when mixed with small amounts of other metals. Gold coins, for example, have a reddish hue. This is because they contain one part of copper to nine parts gold to harden them. Gold becomes paler as silver is added. Nickel whitens gold even more readily than silver does.

Gold is one of the chemical elements. Like other elements, it is made up of atoms. Even though atoms are too small to see under the microscope, chemists have learned some interesting things about them. The lightest of all atoms is hydrogen. An atom

After hours of beating, gold leaf becomes so thin that its particles will disappear into the pores of the skin if it is crumbled in the hand of gold weighs about 197 times as much as a hydrogen atom.

Gold's chemical symbol is Au, from *aurum*, the Latin word for gold. To show its atomic weight you can call it Au 197.

Gold's nearest neighbours, so far as atomic weight goes, are mercury and platinum. Mercury tips the atomic scales at just above 200. Gold miners use this liquid metal in their sluice boxes to surround and capture the particles of gold.

Platinum's atomic weight is 195. A few years ago three scientists at the University of California actually changed platinum into gold. To do this, they bombarded thin sheets of platinum foil in a cyclotron, or atom-smasher. The gold they made was not the same as ordinary gold. Some of the atoms were heavier, others lighter. Instead of Au 197, there were Au 199 and 198, Au 196 and 195, even Au 194 and 193.

These new kinds of gold are called radioactive gold. They give off radiation, which makes a clicking sound in an instrument called a Geiger counter.

The alchemists dreamed for centuries of making gold from some other metal. They did not know about the secrets of the atom, and they failed. Now, at last, the dream of the alchemists has come true. Shall we be richer and happier as a result?

We shall not be any richer in money, because platinum costs even more than gold. But by putting the new knowledge to good use, such as in the treatment of disease, we may be happier.

As was pointed out earlier, your chances of finding a ton of gold nowadays are pretty slim. At least, so says Uncle Sam. His Bureau of Mines at Washington puts out information bulletins for gold-seekers. These remind you that prospectors have searched over the mining regions of the West many times. The hunt has been going on for a hundred years. Few if any easy-to-find deposits remain. Most new mines will be found in places where the veins of ore are underground and out of sight.

"Prospecting for such deposits requires considerable digging," the government warns. The miner must be able to work hard with a pick and shovel, drill holes into hard rock, and use explosives. He must know how to take care of himself in the hills and in the desert.

Even then he leads a lonely life and usually dies poor.

"Probably only one prospector out of several thousand ever finds anything worth developing. Moreover, only one out of every three or four hundred properties developed becomes a profitable

mine." These are the words of the *U.S. Government's Guide to Prospecting for Lode Gold.*

Uncle Sam is glad to buy all the gold you have, but he does not want you to get the idea it is easy to find.

In spite of repeated discouragement, many prospectors spend their lives looking for gold. In the winter they work in a mine for wages. When summer comes they go looking for gold of their own. Old-timers pack their camp outfits, tools, and food on a couple of asses, especially if they are bound for the mountains. But most of today's prospectors like a motor-car better. They go as far as they can by car, then pack supplies on their back the rest of the way if necessary.

Prospectors have an old saying that "gold is where you find it." They mean that gold shows up in unexpected places, and luck plays a part in its discovery.

Nevertheless, an experienced prospector knows how to read the rocks for clues of gold. He looks for pieces of "float." These are fragments torn from gold-bearing veins and carried away by water. Tracing them upstream may lead back to the vein.

The prospector keeps his eyes open for masses of quartz, especially if this hard rock shows streaks and stains of iron rust. This is a sign that iron pyrites may be underneath, and with it, perhaps, gold too. Long ago hot liquids containing these minerals seethed and bubbled deep in the earth. They forced their way into cracks between the rocks and cooled off to form veins.

Suppose a mass of quartz lies covered and hidden from view. The prospector still has ways to spot it. He watches for an unexplained hump of ground. He notices a gully that runs downhill, then swerves off to one side as if to get round something hard. Or he sees a belt of stunted trees and deduces that the roots do not have a chance to push very deep.

Then all he has to do is dig and see if it is really quartz and if the quartz really contains gold.

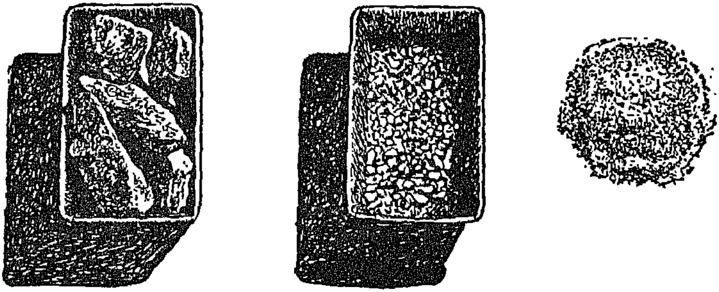
Of course, you can still pan gravel along streams in the gold country. Many high school and college students in the West do this in the summer for fun. They ask some friendly forest ranger about good places to look for gold and they pick up a few tricks of the trade from old-time prospectors. But it's no way to get rich or even make wages. Some pan out a dollar a day, some more, some less.

Probably there will never be another big gold rush, at least not in the United States. But gold-hunting can still be an exciting hobby. There is a thrill in following in the footsteps of the forty-niners and looking for the gold they missed Just a few sparkling yellow grains in the black sand at the bottom of your pan will make your heart jump a beat—and a hundred years seem like only yesterday.

When rivers carry gold downstream, most of the particles sink to the bottom. But some of the fine stuff rides the current until it reaches the sea.

This has been going on for millions of years. So there is bound to be a lot of gold in the ocean by now.

The idea of looking for gold in the sea occurred to a number of smart people a long time ago. What is more, those who took the trouble to sample sea water actually found traces of gold in it.



Early stages of assaying. (Left) Nuggets brought in by prospector; (Centre) after second grinding; (Right) reduced to powder

A Swedish scientist once made up his mind to find out how much gold there was in the ocean. He studied thousands of barrels of water from the Baltic Sea before he came up with an answer. There were eight thousand million tons of gold in the world's oceans, he believed.

Eight thousand million tons!

Other scientists checked sea water in other parts of the world. Their answers came out about the same. It was enough to make one's eyes pop out. Why, with that much gold, everybody in the world could be a multi-millionaire!

If only some way could be found to get the gold out of the sea.

After World War I, Germany desperately needed gold. The defeated country was bankrupt; its money was worthless. Dr. Fritz Haber thought about all that gold washing around in the ocean. Just a little of it would save his country.

Dr. Haber was a brilliant chemist. He held a Nobel prize for his achievements. If anybody could find a cheap way to extract gold from sea water, Dr. Haber should be able to. So he set to work. He found that certain chemicals made the gold separate from the water and collect on sand filters.

The German government gave Dr. Haber a special ship with a gold-collecting plant on board. The expedition was very hush-hush. It would not do for other nations to know about the gold hunt before Germany became rich.

For seven years Dr. Haber and his crew sailed the Atlantic. They tried the water in many places. Then they came home. Years went by. Nobody said a word about the gold.

Finally, in 1952, an American Government official revealed what had really happened on Dr. Haber's long voyage. Dr. Edward Wichers, chief chemist of the National Bureau of Standards, told this story to a meeting of the American Chemical Society.

Dr. Haber had calculated that every 1,200 barrels of water would yield a dollar's worth of gold. Not much, but still he could make it pay.

It seems that the German seafarers toiled as hard for gold as any miners ever did on land. But somehow things did not work out as they had expected. They did not get a dollar's worth of gold from 1,200 barrels of sea water at all. They tried in many different places but still they had no luck.

Finally Dr. Haber had to change his figures. Instead of 1,200 barrels, it would take a *million* barrels of water to produce a dollar's worth of gold!

How was it possible for the first figures to be so far wrong? Dr. Haber found the reason for that too.

There are tiny amounts of gold almost everywhere. During the first tests, a lot of gold slipped into the water that was not supposed to be there. There are specks of gold in ordinary dust, for example. Some of this dust settled in the water. The glassware holding the water and the chemicals that were mixed with it contained traces of gold. While the scientists were at work, bits of gold rubbed off on their fingers from their gold watches and rings. This gold got into the water too. So most of what they measured was gold that is not naturally in sea water at all.

Even though the original figures were almost a thousand times too high, there is still a lot of gold in the ocean. If we could get it out, there would be enough gold to buy every person on earth a new car. But the gold will probably stay in the ocean. There are easier ways to earn a dollar than by straining a million barrels of sea water!

With gold so hard to get nowadays, you would not expect to see much of it coming out of the mines.

Yet, surprisingly enough, the world's production of gold is in the region of £350,000,000 worth a year. That means about 850 tons of gold—many times as much as all the new gold from California in the days of the gold rush.

How is this possible? Two words supply the answer: machinery and science.

Big dredges wade into the creeks of California and Alaska. Moving buckets scoop up the gravel and feed it into sluice boxes. Each cubic yard yields about a shilling's worth of gold. This is very poor pay dirt. No miner with simple equipment could wash it and make a living. But the bucket-line dredges handle so much gravel that they make it pay.

For many years now nearly half the world's gold has come from mines in South Africa. Some of these mines are a mile deep. The ore often yields only one-fifth of an ounce of gold to the ton. That is fifty shillings' worth. To get the fifty shillings it is necessary to blast the ore out of the rock, crush it to powder, and put it through elaborate treatment with chemicals.

An African gold miner using a compressed-air drill

Johannesburg, in South Africa, is a modern city in the middle of a gold field. The region is called the Rand. Mines stretch out for a hundred miles to the east and west. Smoke pours from the tall chimneys of the mills. The Negro miners live in clusters of huts. Piles of white dust, left over from the grinding of the gold ore, are everywhere.

Sheep once grazed over this gold field. They belonged to Dutch settlers who made their homes on the high, grassy plateau. Hunks of rock stuck out of the grass and gave the passing ox-carts a jolt.

It was natural rock but it looked as if someone had stirred up pebbles and stones in cement and let the mixture dry. We call rock like this conglomerate or pudding stone. It reminded the Dutch settlers of a cake, chock-full of almonds, called banket. So they called the rock banket too. But they did not pay much attention to it because you cannot crunch stones as you can almonds. They liked real banket better.

In 1886 a Dutch widow living on a farm near the present Johannesburg employed two men—one English, the other Australian—to build her a new house. They cut into the banket for building stone—and discovered gold. Mixed with the pebbles and cement were flakes of precious metal.

Some almond cake! People from the Cape of Good

Hope, English and Dutch alike, rushed in to cut themselves a slice. Mining men from faraway California joined in the rush.

But it was not like earlier gold rushes. If a man found a good claim, he usually sold it to a mining company. Only a big company had enough money to get the gold out of the banket. The head of one of these companies was Cecil Rhodes. He made a fortune from diamonds, then another fortune from gold, and helped to bring much of Africa under British rule.

It took lots of mercury to capture the particles of gold in the ground-up rock. And after a while mercury alone was not enough. It did the job all right when the ore lay near the surface of the ground. But deeper down the ore changed. It became "refractory." This is a word mining men use to describe ore that will not part with gold without a struggle.

It was so hard to pry gold loose from the deep-lying banket that it looked as though the days of the Rand gold were numbered.

Just in the nick of time came an important discovery—the cyanide process. This new method of extracting gold was put to work in South Africa in 1890. It did the trick. To this day the mines of the Rand are the world's biggest gold producers. And the cyanide process is used all over the world as an important way of winning gold.

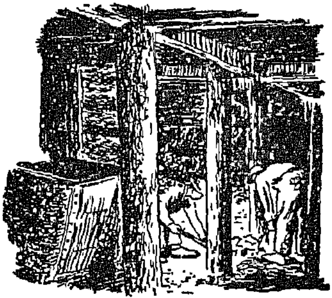
Machinery and science have taken the place of *the lone miner with his pick and pan. On July 4,* 1891, a carpenter struck gold in the crater of an extinct volcano in Colorado. Because it was Independence Day, he called his claims the Washington and Independence mines. They became part of the great Cripple Creek gold field. The carpenter was a free American, but he was not independent enough to develop the mines himself. He sold them to an English mining company for eleven million dollars.

Early in this century big gold strikes were made at Goldfield and Tonopah, Nevada, and in various other parts of the West. Gold-seekers rushed to the spot in motor-cars and staked out claims. If the claims were any good they sold them to mining companies. If not, they drove away. It was not like the old gold-rush days.

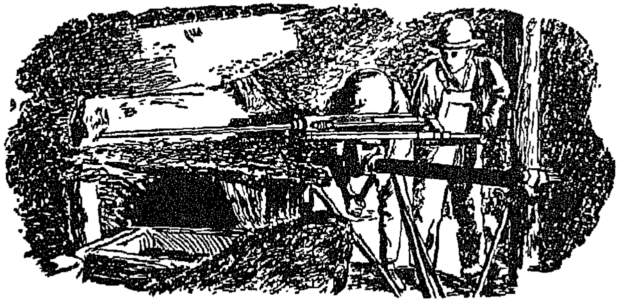
Today one of the biggest gold mines in the United States is the Utah Copper Mine at Bingham, Utah. Enough gold is mixed with the copper ore to make it an important gold mine too. More than a quarter of the country's gold now comes from copper, lead, and zinc ores.

Canada produces about twice as much gold as

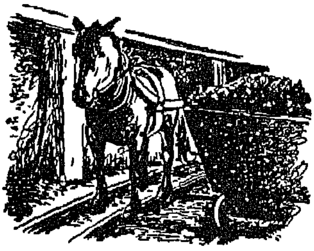
BLASTING—THEIR DAY'S DRILLING DONE, THE MINERS TAMP DYNAMITE INTO THE HOLES, PREPARE TO BLAST.



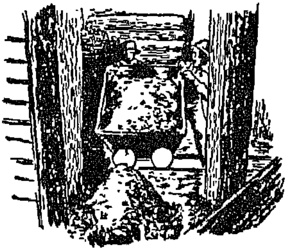
MUCKING UP—AFTER THE DYNAMITE IS SET OFF THE MINERS MUCK (SHOVEL) THE DEBRIS INTO TIP CARS.



DRILLING—THIS IS ONE OF THE LESS DANGEROUS TASKS OF THE MINER—UNLESS THE 120 LB. DRILL FALLS ON HIM. NOTE THE SQUIRMING TANGLE OF PIPES CARRYING COMPRESSED AIR AND WATER TO WASH OUT THE HOLES.



TRAMMING—THE ROCK IS HAULED IN TRAMS BY MEN, HORSES, STORAGE-BATTERY ENGINES TO THE CHUTES.



DUMPING—THE ROCK AND ORE ARE DUMPED DOWN A CHUTE LEADING TO THE BOTTOM OF THE MINE.

the United States. The most important Canadian mines are in the province of Ontario. The Porcupine gold camp has been famous since 1909 and Kirkland Lake since 1912.

A still bigger gold producer is Russia. The United States Bureau of Mines estimates that in recent years newly mined Russian gold amounts to about a fourth of the world's total production. Much of Russia's gold comes from Siberia, especially along the Lena River, which empties into the Arctic Ocean.

South Africa, Russia, Canada, and the United States, in that order, produce together about 80 per cent. of the world's gold today. The rest comes from Australia, West Africa, Rhodesia, Mexico, the Belgian Congo, Colombia, Nicaragua, Chile, and India, and, in smaller amounts, from many other nations.

Let us take a look at the largest gold mine in the United States. It is the Homestake Mine at Lead, South Dakota, just up Gold Run Gulch from famous Deadwood.

The town of Lead clings to the side of a steep hill. Perched above the houses are the sprawling mill and mine shaft buildings of the Homestake plant. The company conducts regular tours through these surface workings. If you are in the Black Hills,

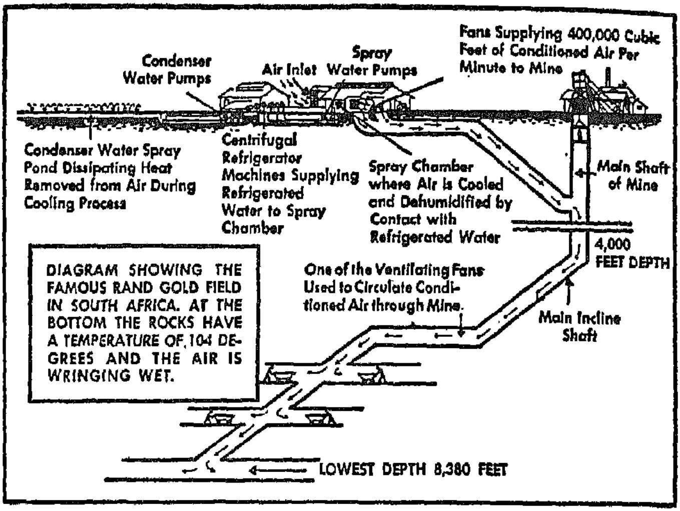


DIAGRAM SHOWING THE FAMOUS RAND GOLD FIELD IN SOUTH AFRICA. AT THE BOTTOM THE ROCKS HAVE A TEMPERATURE OF 104 DEGREES AND THE AIR IS WRINGING WET.

Condenser Water Pumps
Air Inlet
Spray Water Pumps
Fans Supplying 400,000 Cubic Feet of Conditioned Air Per Minute to Mine
Condenser Water Spray Pond Dissipating Heat Removed from Air During Cooling Process
Centrifugal Refrigerator Machines Supplying Refrigerated Water to Spray Chamber
Spray Chamber where Air is Cooled and Dehumidified by Contact with Refrigerated Water
Main Shaft of Mine
4,000 FEET DEPTH
One of the Ventilating Fans Used to Circulate Conditioned Air through Mine.
Main Incline Shaft
LOWEST DEPTH 8,380 FEET

you can go on a tour and watch them extract gold from ore.

The ore comes from tunnels and chambers deep under the town. Two hundred miles of underground passageways, connected by shafts and ore chutes, make the inside of the mine a vast honeycomb. The miners work on twenty-seven different levels, one below another. The lowest level is a mile below the surface. Homestake is a hard-rock mine. The ore is harder than granite. The miners push sputtering air drills into the rock to make holes for dynamite charges. They shove three million sticks of dynamite into these holes every year. The blasts tear loose huge chunks of rock.

Four thousand short tons of rock a day move from the mine to the mill. Inside the mine is a miniature railway system, eighty miles long. Locomotives no taller than a man pull strings of ore cars to the mine shafts.

Each car or wagon carries three tons of ore. At the end of the line, the car turns over on its side and dumps its load. Three carloads of ore fill one bucket. The mine hoist yanks these buckets up the mine opening at a high speed.

Over sixteen million dollars' worth of gold comes out of the Homestake every year. But a miner can work all his life in the diggings and never see anything that looks like gold. Each short ton of ore contains only a quarter of an ounce of gold—not enough to show.

Near the mine opening, massive "jaw breakers" crush the big chunks of rock into pieces the size of plums. This is still too big. The ore passes to the mill building. Here, iron-shod stamps, rising and falling, smash it into cherry-sized lumps.

The next stopping place is the rod mills. These are huge revolving cylinders. Loose steel rods tumble around inside. They break the lumps into grains as small as wheat. Here also the ore gets a mercury bath. Mercury forms a putty-like amalgam with the coarser gold. The mixture flows over copper plates, coated with mercury, and sticks on the plates. It looks grey and silvery—not like gold at all.

Some of the ore needs a still finer grind. It goes into the ball mills. Knocking around inside these mills are cast-iron balls. This time the ore comes out as fine as flour. But you still wonder where the gold is. What you see looks like wet, black sand.

During the milling process, mercury captures three-fifths of the gold. After no more gold can be won this way, the wet sand flows through pipes to the cyanide plant. Workers separate it into sand and slime.

A solution of cyanide percolates through the sand and passes through the slime under pressure. This solution frees the gold from the other minerals and carries the precious metal along with it. Later, zinc dust is fed into the gold-bearing solution. The gold separates out as part of a black, muddy deposit.

Only in the refinery does anything resembling gold show up. The amalgam goes into a retort, where the mercury passes off as vapour. The black sand from the cyanide plant loses its base metals by purification. When the refining processes are over, streams of real gold pour out of the crucibles into moulds. The gold hardens into sparkling bricks of gold, ready for shipment to the United States Mint at Denver. Each brick weighs five hundred ounces and is worth about $17,500.

Out of four million pounds of hard rock comes just one gold brick like this. So naturally no gold goes to waste if there is a way to save it. A dust collector traps the fumes from the refinery furnaces for any gold they contain. Moppings and sweepings from the refinery floor get respectful treatment too. And when a refinery worker's overalls wear out, he would not dream of throwing them away. Traces of gold dust have sifted into the cloth and must be reclaimed. The old overalls are worth twice as much as a new suit.

6: GOLD—
TWENTY-THREE THOUSAND MILLION POUNDS' WORTH

ALL the gold ever dug by man is probably worth a little more than twenty-three thousand million pounds. It weighs nearly sixty thousand tons. A single lump containing all this gold would fit comfortably into a school gymnasium.

But of course it is not in a single lump. Where, then, is this twenty-three thousand million pounds' worth of gold?

The United States Treasury has the largest share. The amount changes from time to time, but in recent years it has been about twenty-two or twenty-three thousand million dollars, roughly eight thousand million pounds.

The Governments of various other countries, and the central banks through which they do business, have another four or five thousand million pounds in gold, more or less. This does not include Russian gold, which may amount to several thousand million.

So, all told, the world's Governments probably have some fifteen thousand million pounds' worth of gold. This is called "monetary gold," but it is not money in the same way gold coins used to be. Government gold is mostly in the forms of bars called bullion. It stays in vaults for safe keeping. Few people ever see it. But they know it is there, and, as a result, have more faith in their country's money.

When one nation owes money to another, it may send gold bars to pay the bill. Gold is one article that every country is always glad to get. It is an international form of money.

In some parts of the world people hoard as much gold as they can get hold of. They hide a few gold coins in the mattress or in a tree stump. If they are rich, they buy gold bars and keep them in a safe-deposit box at the bank. In the troubled years after World War II, hoarding became common in France and other parts of Europe. Ordinary money fell in value so often that gold seemed safer to have.

Gold hoarding has been going on for centuries in India and the Far East. It is the ordinary way of saving. Gold does not pay interest, like money in the savings bank. But it is nice to look at and easy to melt down and sell in time of need. A maharajah may have a roomful of dazzling gold plate. Poor people are happy to have enough gold to make a ring for the daughter of the family. Gold like this serves as both savings and jewellery.

The hoardings of private individuals may well approach four thousand million pounds' worth of gold. That leaves four thousand million more to account for.

This last four thousand million pounds' worth of gold is not in the form of money at all. Millions of watches and rings each contain a little gold. Men carry gold around in cuff-links and tie-pins. Women wear it in brooches, necklaces, bracelets, and earrings.

Much of the gold of the past is in museums and churches in the form of jewels, vessels, and gilding on robes and picture frames. Some is on palace walls and in the crown jewels of royalty.

People also have tens of millions of pounds' worth of gold in the fillings of their teeth.

Some of the gold has been lost. A little constantly rubs off coins and rings. Traces of gold vapour go up the chimney when old gold is melted, no matter how carefully the refinery workers try to catch it.

Gold lies in treasure chests in the holds of sunken ships and on lonely beaches as forgotten pirate gold. Pirates sometimes buried gold rather than risk losing it in a fight at sea.

Honest people also bury gold when they expect trouble. If the trouble is bad enough, they do not always get back to dig up the gold. It may stay in the ground a long time before someone finds it.

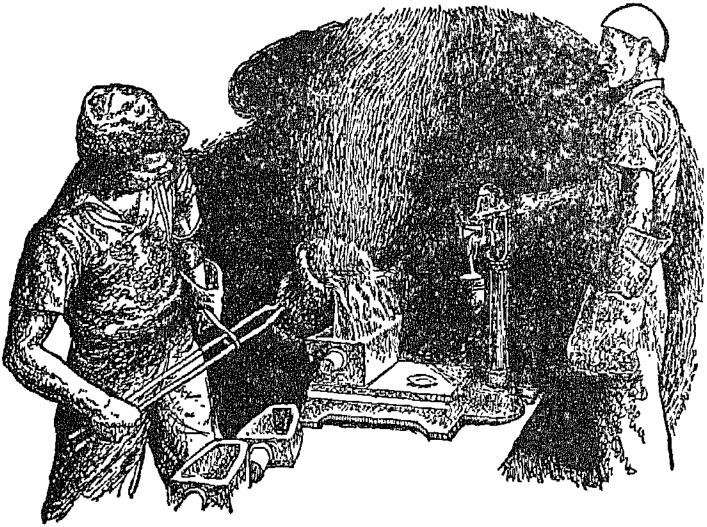
In 1902, for example, a Greek farmer and his friends uncovered a treasure in gold jewels in a field on the island of Cyprus. There were necklaces, bracelets, earrings, girdles, and medallions—all more than a thousand years old. Perhaps the original owners buried the treasure and fled when the Arabs invaded the island in the seventh century.

But it is not likely that a great deal of gold has been lost. Most of it, even if mined thousands of years ago, is probably still around. People do not throw gold away.

Did you ever see a gold sovereign? It is worth more than one pound now, but it is no longer used as currency. In fact, it is against the law to use gold coins for money. It is also against the law to hoard them. Gold is now money for Governments. But Governments use bullion, not coins.

The United States Treasury owns more than a third of all the gold in the world and keeps it in six different places.

Part of the gold is in the United States Assay Offices in New York and Seattle. These offices test gold bars for purity and weight. They have scales so delicate that the assayer has to pull glass doors shut when he weighs a sample of gold. If he did not, his breath might change the weight. Other scales are nine feet high. These big scales can weigh gold



worth anywhere from 35 cents to right up to $350,000.

Other gold bullion is in the United States Mints at Philadelphia, San Francisco, and Denver. The Mint at Denver has about six thousand million dollars' worth. A lot of gold was taken there from the West Coast during World War II after the Japanese attack on Pearl Harbour.

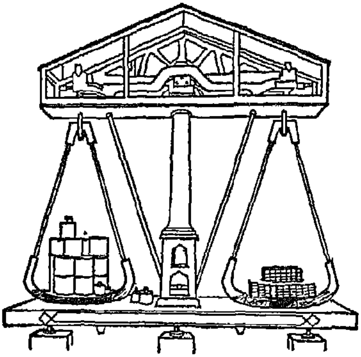
The most famous gold storage place of all is at Fort Knox, Kentucky. The United States keeps over half its gold here—from twelve to fourteen thousand million dollars' worth in recent years. It stays in a huge bomb-proof vault on a military reservation thirty miles from Louisville. The vault has two floors, one underground. It is inside a tomblike building called the United States Treasury Department Bullion Depository.

Nowhere in the world is there so much gold as here. Sightseers can look at the building only from a distance. A high steel fence surrounds it. At each corner rises a pill-box, with armed men inside. At night floodlights make the place bright as day.

Robbers would have a hard time getting in. Even if they slipped by the guards and tried to enter the building, they would cause an awful racket. Alarms and sirens would go off. Guards inside could summon help by telephone and short-wave set. Two army divisions would come running from Fort Knox, if need be.

Meanwhile, the robbers would make little headway. Even if they had acetylene torches, they could not cut through the massive vault doors. It takes the working of two combinations to open them. Only Treasury officials know these combinations. And no man in the world knows *both* combinations!

Gold moves in and out of Fort Knox by registered mail. Postal inspectors and Secret Service men see it on its way. A big shipment goes by special train with troops guarding it. If all the gold at Fort Knox were sent somewhere else, the postage would come to about two million dollars.



The huge scales of the United States Assay Office are so delicately balanced that they can weigh even the amount of lead or ink it takes to write your name

People often ask, "What good does the gold do, buried there at Fort Knox? For ages men suffered hardships to get gold out of the ground. Now we go and put it back in the ground. Does that make sense?"

The United States Government's reply is that the gold helps to keep money on an even keel. The U.S. Treasury has a standing offer to buy gold at thirty-five dollars an ounce, less a small charge for handling. It pays this price to mining companies in the United States. It does the same for foreign banks and Governments that want to sell gold for dollars.

If another country has some dollars, and wants gold instead, that is all right too. The Treasury will do business either way. It sells gold at thirty-five dollars an ounce, plus a small handling charge. As long as gold is bought and sold at this price, the dollar has a steady value throughout the world.

The Federal Reserve Bank of New York has about six thousand million dollars' worth of gold—one-tenth of all the gold ever mined by man! Strangely enough, all this gold belongs to foreign countries. Some of them sent it to the United States for safety during World War II. After the war they left it there. New York is now the money centre of the world. It is a convenient place to store gold.

If France wants to pay the United Kingdom a million dollars in gold, it is not necessary to send a ton of heavy metal from Paris to London. It is much simpler to ask the Federal Reserve Bank to take care of the matter. A man pulls a hydraulic lift truck into the cage containing France's gold. He loads on seventy-two bars and takes them into the cage where the United Kingdom's gold stays. The job is done!

These bars look like building bricks. It would cost a lot to build a house of them, for each bar is worth fourteen thousand dollars. Men who handle gold bars wear steel toeguards. Once in a while a bar tumbles off the truck—and it weighs between twenty-seven and twenty-eight pounds.

Bars of this size are "Assay Office bars" or "Mint bars." Each contains four hundred ounces of gold. Gold comes in "troy" ounces, by the way. These are a little heavier than ounces in avoirdupois measure. A troy ounce is 480 grains against the 437.5 grains of the ordinary avoirdupois ounce, so there are only just over fourteen and a half troy ounces of gold to an every day pound.

The gold in Mint bars is at least "995 fine." This means 995 parts out of 1,000 are pure gold. The other five parts are mostly silver, but there may be traces of lead, copper, zinc, and other metals.

A few bars differ in size and shape. Among these are British Mint bars and Rand bars from South Africa. There is also some coin gold 900 fine. These bars contain one-tenth copper to harden the gold for coin. You can recognize them by the reddish hue.

A certain amount of gold is always moving back and forth between New York and Europe. You would think it would go by ocean liner, but usually gold travels by air express. It is cheaper that way. Flying is so fast that the saving on insurance more than makes up for higher transport charges.

Every Friday at 4 P.M., the big vault door at the Federal Reserve Bank closes, with the time lock set for 8 A.M. Monday.

Suppose someone got locked in by mistake? He would spend a lonely week-end but he would not starve. Food, fruit juices, and water are stored in a cupboard in the vault, just in case such a mistake ever happens. There is a telephone too. The prisoner could talk to anyone he liked while he sat on six thousand million dollars' worth of gold.

7: BEAUTIFUL AND USEFUL TOO

Doctors now use radioactive elements produced in atomic energy plants to study and treat various diseases. One of these elements is radioactive gold, called radiogold for short.

Radiogold gives off rays somewhat similar to X-rays in their effect. For this reason, doctors want to find out whether it can be used in place of X-rays to stop the growth of certain kinds of cancer. For a long time they have used X-ray treatments as one method of fighting cancer. The trouble with X-rays is that they must pass through healthy skin and tissue before they can bombard the cancer. Thus, X-rays must be used sparingly so that they will not cause burns on the way to the target.

Doctors can inject a jelly-like solution of radiogold right into the diseased tissue. They want it to stay there and destroy cancer cells without harming normal body cells. Perhaps radiogold will prove a useful tool in the treatment of some types of cancer. Of course it is only one of many attempts to deal with this mysterious disease. But it is good to know that gold has come into the atomic age with powers that doctors find worth looking into.

Dentists have used gold for a long time. Gold helps improve the teeth of young people and repair the teeth of older people.

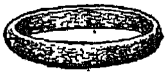
Boys and girls who bear braces to straighten their teeth naturally find them a nuisance. Nevertheless, they would certainly be a lot worse off were it not for gold.

The braces are an intricate arrangement of wires, tubes, bars, hooks and arches—all made of alloys of gold.

No other metal has the "give" and spring to do the job so well. The dentist can heat and bend gold for a better fit. It cools off and is as strong as ever. Gold does not start chemical actions in the mouth that might harm the tissues. It does not tarnish either. A mouthful of metal may not be pleasant, but only gold could be so thin and yet so strong. Anything attached to the teeth has to take a lot of punishment. Gold can take it.

Dentists and dental laboratories use various gold alloys to cast inlays and make other tooth repairs. Makers of alloys sell dental gold in little one-pennyweight nuggets. Each nugget weighs one-twentieth of an ounce and is ready for casting. When the dentist asks the patient to bite into something soft, he is taking an impression—the first step in the preparation of a mould. The hot metal cools inside the mould. It becomes a gold inlay and fits snugly into a tooth cavity.

Dental alloys of gold may contain such metals as copper, platinum, palladium, silver, zinc, or nickel. Some look like yellow gold, others are "white gold." Adding these other metals makes gold harder. A soft alloy is good if a tooth does not get much banging around. Crowns and bridgework call for something harder.



Old gold piles up all the time.

A woman gets tired of her ring. Pieces of broken jewellery turn up in the attic. A watch stops running. A man gets a new pair of spectacles and frames. A jewellery worker sweeps up the gold filings under his bench. A dentist removes old bridgework from a patient's mouth. Crooked teeth grow straight, and off come the braces.

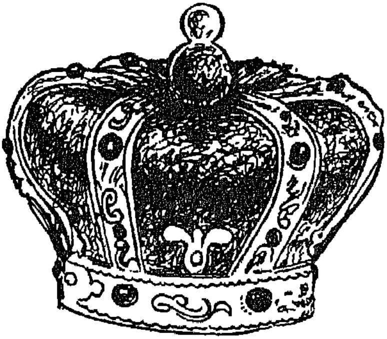
But gold never reaches the junk pile like scrap iron or an old car. People send it to an old-gold dealer or to a refining plant.

Into the melting furnace goes the old gold. Men skim off impurities as slag. In one process, chlorine gas bubbles through the molten gold and carries away base metals as fumes. In another, the base metals pass into the porous walls of a pot. Soon the old gold is as good as new.

Most likely the old gold will go to a dentist or a manufacturer of jewellery, watches, or spectacles. Some gold ends up in the nibs of fountain pens. A tiny bit goes into gold-coloured paint and ink, but these are made mostly of imitation gold. Otherwise they would cost too much. People like to have their initials "stamped in gold" on wallets, suitcases, and hat-bands.

A book sometimes carries its title on the binding in letters of gold. Sometimes this is real gold, usually not. But gold leaf is so extremely thin that it costs only a few pence to stamp the binding of a book in genuine gold.

The domes and towers of some large buildings have a gilding of gold leaf. The gold stays bright and shiny through wind and storm. Gold might have other uses in the building trades if it were cheap. Professor Carle R. Hayward of the Massachusetts Institute of Technology says that gold would be excellent for roofs. He thinks that plumbing should be of gold too, or at least plated with gold. But if gold were cheap enough for that, would ladies still want to wear gold jewellery? The professor believes not.



Gold was first used to make jewellery. Next to money, jewellery is still its most important use.

Some jewellery manufacturers buy pure gold from the refinery. They make their own alloys or use the gold to plate other metals. Most jewellery makers, however, prefer to buy gold alloys in the form of "carat gold."

Pure gold is 24-carat gold. An alloy that is half gold and half other metals is 12-carat gold. The number of carats tells you how many parts in twenty-four are gold.

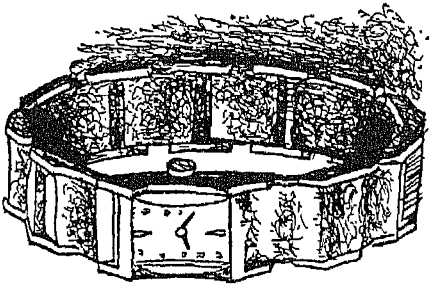
Nine-carat and 14-carat golds are especially popular in jewellery. A 9-carat ring is a little less than half gold. A 14-carat ring is slightly more than half gold.

Jewellers sometimes offer low-priced jewellery as "12-carat gold-filled" or "10-carat rolled gold plate." "Filled" or "rolled" means that the object has a thin layer of gold outside and cheaper metal inside. The carats refer to this outside layer, not to the entire piece.

Refiners make carat gold into various shapes and colours. They roll it into sheets and strips or draw it into wire. By heating the gold from time to time they can keep it soft enough to work with. Most carat gold is yellow or white, but it also comes in shades of green, red, and pink. "White gold" used to refer to gold with lots of silver, but in the jewellery business today it usually denotes an alloy of gold, copper, zinc, and nickel.

Everybody wants to own a gold watch. A gold watch is more than just a watch with a gold case.

The finest workmanship goes into it. Look at the dial and you will see that the hands and the tiny numerals are also of gold. Did you ever wonder what makes the numerals stay in place? They are not glued there. Each numeral has two little gold "mounting feet" to hold it steady. A machine raises these two feet out of a small gold disc in a single operation. Another machine stamps out the numerals, leaving the feet in just the right place.



Even the balance-wheel screws of a gold watch may be gold. And if it is a wrist watch, it probably has a gold bracelet attached—the kind that stretches to fit comfortably on the wrist.

It's funny about gold. People in ages past were sure the world used to be a better place before gold turned men's heart to evil. But what do you suppose they called those happy days of long ago when life was good and gold unknown? You guessed it. The Golden Age!

It is true that once gold was discovered, it changed the world. It led to wars of conquest and slavery in mines. But it also led to travel and knowledge of other lands. Gold promoted trade between nations and an understanding of chemistry. It supplied money to start great industries.

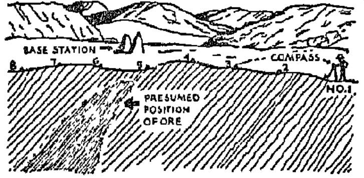
The Sermon on the Mount has a rule for conduct towards others which has become the best known of the world's great moral teachings:

"Therefore all things whatsoever ye would that men should do to you, do ye even so to them," it reads.

Men call these words the Golden Rule.

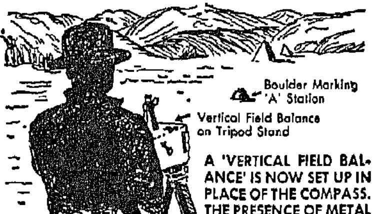
HOW THE NEW RAND GOLD REEF WAS FOUND
-MAGNETIC METHODS-

1.



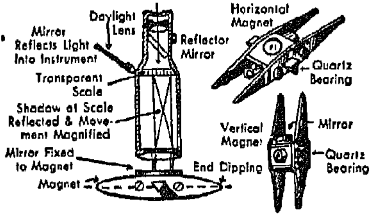
AN AREA IS MARKED OUT FOR SURVEY BY PLACING BOULDERS REPRESENTING A NUMBER OF 'STATIONS' AT EACH OF WHICH THE SURVEYOR FIRST HAS TO OBTAIN BY COMPASS THE MAGNETIC MERIDIAN.

2.

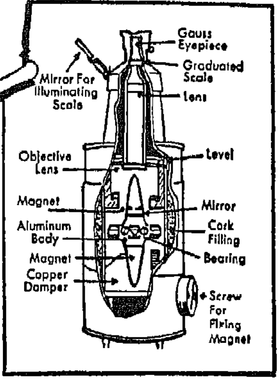

Boulder Marking 'A' Station
Vertical Field Balance on Tripod Stand

A 'VERTICAL FIELD BALANCE' IS NOW SET UP IN PLACE OF THE COMPASS. THE PRESENCE OF METAL BELOW THE SURFACE IS INDICATED BY A DEFLECTION OF THE MAGNET IN THE INSTRUMENT. THE DEFLECTION & TIME OF READING IS RECORDED BY THE SURVEYOR.

3.



THE MAGNET 'DIPS WHEN NEARING THE UNDERGROUND ORE BODY, THE MOVEMENT IS SEEN ENLARGED WHEN VIEWED THROUGH THE INGENIOUS OPTICAL SYSTEM IN THE INSTRUMENT.



THE HORIZONTAL FIELD BALANCE

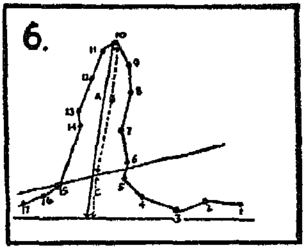
THIS INSTRUMENT MEASURES THE NORTHWARD MAGNETIC FORCE WHILE THE VERTICAL FIELD BALANCE MEASURES THE DOWNWARD MAGNETIC FORCE.

4.

HAVING COMPLETED THE READINGS FROM THE VERTICAL FIELD BALANCE, THE SURVEYOR NOW WORKS OVER THE SAME AREA WITH THE HORIZONTAL FIELD BALANCE TO OBTAIN RECORDS OF MAGNETIC VARIATIONS AT EACH STATION.

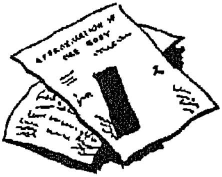
5.

ANOTHER SURVEYOR AT THE BASE STATION TAKES READINGS OF TERRESTRIAL MAGNETISM, HIS OBSERVATIONS BEING SYNCHRONIZED WITH THE SURVEYOR IN THE FIELD.



6.

A GRAPH OF THE COMBINED READINGS IS MADE AND BY SUBTRACTING THE AMOUNT OF TERRESTRIAL MAGNETISM A TRUE READING OF THE DEFLECTION CAUSED BY THE ORE IS OBTAINED.

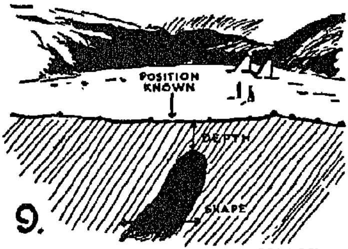


7.

BEING FAMILIAR WITH THE GEOLOGY OF THE GROUND, THE SURVEYORS ARE NOW ABLE TO GUESS ROUGHLY AT THE PROBABLE SHAPE OF THE ORE BODY.

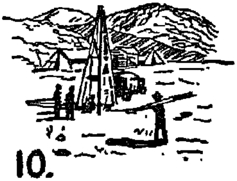
8.

AS THE RESULT OF MATHEMATICAL CALCULATIONS NUMEROUS FURTHER GRAPHS ARE PRODUCED UNTIL ONE IS FOUND MATCHING THAT PRODUCED BY THE FIELD BALANCE READING.



9.

THOUGH NOT KNOWING THE COMPOSITION OF THE DEPOSIT, THE SURVEYORS HAVE DETERMINED ITS POSITION, APPROXIMATE SHAPE AND DEPTH BELOW THE SURFACE FROM THE COMBINED FIELD BALANCE READINGS & CALCULATIONS.



10.

ALL THAT NOW REMAINS IS TO BORE & DIG TO OBTAIN DETAILS OF THE CONSTITUENTS OF THE UNDERGROUND MAGNETIC MASS. PERHAPS WITHIN IT MAY BE FOUND PRECIOUS NON-MAGNETIC GOLD.

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